REPORT No: P WMA 19/000/00/0507
Volume 7 of 7

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
Directorate: National Water Resource Planning

WESTERN CAPE WATER SUPPLY SYSTEM: RECONCILIATION STRATEGY STUDY

Summary Report

FINAL

June 2007

CITY OF CAPE TOWN | ISIXEKO SASEKAPA | STAD KAAPSTAD

Submitted by:
Ninham Shand (Pty) Ltd in Association with
UWP Consulting (Pty) Ltd

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WESTERN CAPE RECONCILIATION STRATEGY STUDY

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THE WESTERN CAPE WATER SUPPLY SYSTEM RECONCILIATION STRATEGY

EXECUTIVE SUMMARY

Background

The Department of Water Affairs and Forestry (DWAF) together with the City of Cape Town (CCT) commissioned the Western Cape Reconciliation Strategy Study (WCRSS), to facilitate the reconciliation of predicted future water requirement scenarios with supply from the Western Cape Water Supply System (WCWSS) for a 25 year planning horizon. The Study seeks to provide a decision support framework to facilitate timeous decision making of appropriate water resource and Water Conservation and Water Demand Management (WC/WDM) interventions necessary to ensure that the future water requirement can be met on a sustainable basis.

The WCWSS serves more than 3 million people and provides water to the communities of CCT and certain Overberg, Boland, West Coast and Swartland towns, as well as the irrigators along the Berg, Eerste and Riviersonderend Rivers. Urban use within the CCT is the largest water use from the WCWSS. The total present water use within the WCWSS area is estimated at about 465 million m^3/a. The existing sources of the WCWSS can yield about 475 million m^3/a (at a risk of failing on average once in 50 years to supply this full requirement). During periods of drought, such as occurred in 2000 and during the winters of 2003 and 2004, water restrictions are introduced to reduce the requirement on the system. From 2007 onwards, the Berg Water Project (BWP) will increase the water availability by about 81 million m^3/a, increasing the total availability to 556 million m^3/a, and therefore water restrictions are not likely to be required during the following few years, under average runoff conditions.

Future Water Requirements

Updated future water requirement scenarios were developed as part of the WCRSS using an updated water requirement forecast model. The model is based on the historic trends in terms of water demand, population and economic growth rates. Two future water requirement scenarios were developed. For the High Water Requirement scenario, with high economic and population growth, the total system requirements would grow from 502 million m^3/annum in 2006, to 935 million m^3/annum in 2030, and for the Low Water Requirement scenario from 465 million m^3/annum in 2006 to 670 million m^3/a in 2030. These scenarios did not take account of water conservation and demand management, as these are included as interventions that could be selected to reduce the future water requirement.

The future water requirement scenarios as well as the existing system yield are shown in Figure E1.

Reconciliation Themes

A stakeholder workshop to obtain buy-in and guidance on the strategy content, composition and format was held on 25 January 2006. After a series of working sessions by the Technical Focus Group (including officials from the DWAF, CCT, Western Cape Provincial Department of Agriculture and the consultant team), a draft strategy was developed. Nine strategic themes, which encompass current and proposed future activities to address the various key issues, were identified and developed. Each theme describes the issues, approach, activities and responsibilities that are required to support the decision-making process. Timely preparatory measures, assignment of roles and responsibilities and consequent actions are required to ensure implementation of appropriate interventions. The nine themes are listed below:

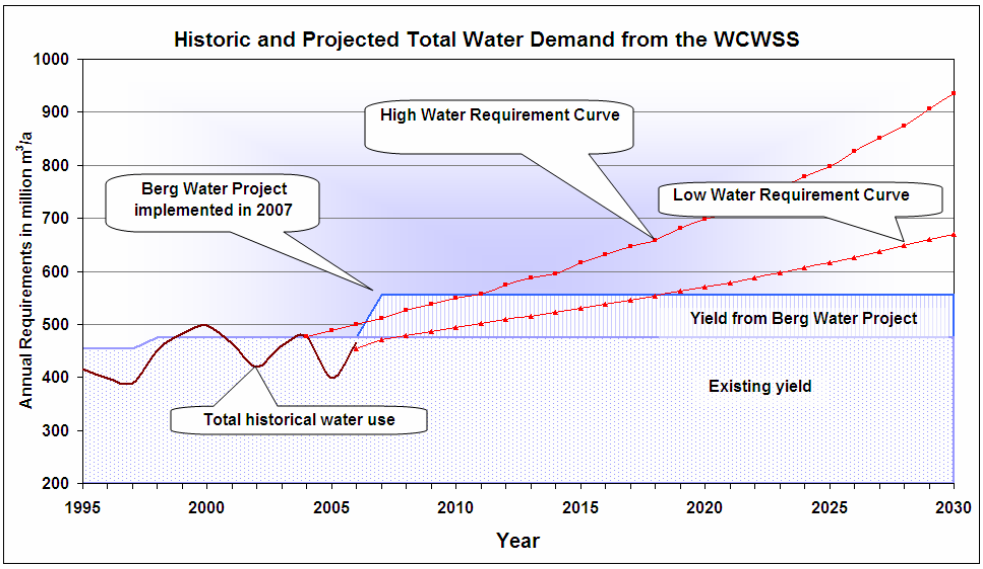

Figure E1 Comparison of historical water requirement and a high and a low future water requirement scenario, with the available yields from the WCWSS

- Water requirements;
- Water use efficiency;
- Water availability and system operation;
- Comparison of requirement and availability;
- Selection of interventions and decision-making process;
- Water resources protection and management;
- Stakeholder engagement;
- Monitoring and information management; and
- Strategy implementation and performance assessment.

The Strategy supports an adaptive approach to water resource management and is a living document, to be continuously improved as estimates of water requirement, water availability and resource development options become better understood and are more reliably quantified.

Public Consultation

The Reconciliation Strategy Study was designed to facilitate input from stakeholders and the public. Four newsletters inviting feedback on the study were distributed to a mailing list of Interested and Affected Parties. In addition, five public meetings were held at different locations in the supply area of the WCWSS. Presentations on the progress of the Reconciliation Strategy Study were also made to the Breede and Berg CMA Reference Groups on a number of occasions.

Study Selection Process

The Strategy outlines two selection processes, namely:

- **A study selection process**: To identify interventions requiring additional studies (at feasibility or pre-feasibility level). The selection is based on comparing intervention scenarios. The information obtained from the studies will inform the final selection process; and

- **A final selection process**: This comprises a process to recommend the most suitable intervention for implementation. This process was not carried out during the scope of the current study but recommendations have been made on the approach to the process.

The study selection process utilised for the selection of interventions is described below:
Step 1: Identify interventions
Step 2: Screen interventions
Step 3: Public Review of Selected Interventions
Step 4: Scenario Planning Process
Step 5: Review of selected intervention scenarios by water institutions, authorities and local political representatives.
Step 6: Obtain public feedback on scenarios
Step 7: Initiate studies

Once all the selected interventions have been studied to the same level of information, the DWAF and the CCT, in dialogue with other stakeholders, will take a decision on which interventions should be implemented. This process to select interventions for implementation, called the Final Selection Process, will be determined by the future Strategy Committee.

The Scenario Planning Process
The objective of the Scenario Planning Process (Step 4) is to identify, evaluate and assess alternative groupings and phasing of interventions in order to determine the most appropriate combination of interventions that should be implemented, to reconcile water supply and requirement in the WCWSS. The combination of interventions selected to meet the requirement, is termed a scenario. Due to the lead times required for feasibility studies, interventions need to be identified well in advance, so that they are ready for implementation within the required time frame. While conducting the feasibility studies, some interventions may be found not to be suitable for implementation. For that reason, the scenario planning process considers a range of possible scenarios to reconcile water supply and requirement. The objective is not to select one "favourable scenario" but to identify which interventions should be studied to allow consideration of a range of possible scenarios. This will allow the DWAF and the CCT, and other stakeholders, the maximum amount of flexibility in making informed decisions on which interventions to implement after the BWP, and beyond. The outcome of the process is a list of interventions that should be studied, by specific dates, so as to facilitate the implementation of a range of reconciliation scenarios.

During the Study, twelve possible scenarios for reconciling the water requirements with the available resources were tested against the determined water requirement curve(s). The time required to implement the interventions, as well as the costs and associated risks were carefully considered.

A range of scenarios was utilised to *inter alia* assess the following:

- The benefits of implementing WC/WDM;
- The reconciliation and supply implications of implementing the ecological Reserve for existing water resources; and
- The reconciliation and supply implication arising from climate change.

Conclusions

An important finding of the Reconciliation Strategy Study was the importance of the CCT's 8-year WC/WDM Strategy and programme for reconciling future water supply and requirements. It is imperative that the CCT implement its 8-year WC/WDM Strategy as well as investigate additional longer-term WC/WDM interventions, as the long lead times required to implement a supply-side intervention preclude the selection of any supply-side interventions prior to 2013 under the High Water Requirement (HWR) curve. Should the CCT be successful in implementing its 8-year WC/WDM Strategy then the next reconciliation intervention could be delayed until 2015. Whilst the CCT has been specifically mentioned, it is equally important for all other Water Service Authorities in the supply area of the WCWSS to implement their respective WC/WDM strategies and programmes.

If the CCT is unsuccessful in implementing its WC/WDM Strategy and programme, and assuming that the HWR curve is followed, then the requirement will exceed the supply in 2011 and the CCT will face an increased possibility of having to impose water restrictions on its consumers. Under these circumstances, the Table Mountain Group Aquifer Scheme and/or other supply-side interventions will have to be "fast tracked" or the implementation lead times of certain interventions will have to be reduced.

The Reconciliation Study has also highlighted the potential importance of groundwater and interventions that use treated effluent to ensure the reconciliation of supply and requirement in the longer term.

Desalination of sea water also remains an option for the CCT and other Water Service Authorities in the WCWSS area. This option, although currently more expensive, should be studied further and could be seen as a "backup option".

The future implementation of the ecological Reserve of the existing water resources and the potential impacts of climate change would also require that additional reconciliation interventions are studied in 2007 in order to offset any potential decrease in the yield of the existing system.

A number of requirement and supply-side interventions should be studied in more detail by DWAF and the CCT to ensure the reconciliation of supply and requirement to the year 2030. It is also imperative that a number of these studies commence in 2007 as the lead time to implement certain supply-side interventions could be as long as 10 years.

Recommendations

Based on the findings of the study, the following recommendations are put forward to ensure ongoing reconciliation of supply and requirement within the WCWSS.

General Recommendations

a. A Strategy Steering Committee, supported by an Administrative and Technical Support Group, should be formed in order to make recommendations, on an annual basis, on long-term planning activities required to ensure reconciliation of requirement and available supply in the WCWSS area.
b. Actual population and economic growth rates, as well as actual water use by user category, need to be monitored and updated in the water requirement model, so that future water requirement projections can be accurately monitored and predicted.

c. Commitment to and endorsement of WC/WDM by all role-players in the water sector should be obtained and/or enhanced to ensure an environment conducive to the implementation of WC/WDM measures on a sustainable basis.

d. Water use efficiency must become central to all WSAs' planning and WSPs' operations and the capacity of the respective institutions should be enhanced to ensure effective implementation of WC/WDM. Activities undertaken by WSAs should include:

- Reviewing tariffs to reflect scarcity of water supplies,
- Maintaining high profile community information and education campaigns,
- Promoting water use efficiency,
- Ensuring that water-efficiency measures/devices are implemented/installed for all new consumers and
- Ensuring appropriate monitoring/tracking and reporting of all aspects of WC/WDM.

e. In terms of water re-use, it is recommended that the following aspects be investigated:

- Treatment works which produce higher quality effluent and are therefore better suited to service potable use schemes,
- The location of industrial centres that could be serviced by re-use schemes,
- Opportunities for using treated effluent to meet riverine Reserve requirements, and
- Opportunities for extending “local irrigation” with treated effluent schemes and to provide supplies for domestic gardening and/or toilet flushing supplies.

f. WUAs should be encouraged to develop water management plans (WMPs), as required under the National WC/WDM Strategy, for the agricultural sector.

g. The operation of the WCWSS could be further improved by monitoring individual abstractions (by installing water meters for surface water use, cumulative flow meters on boreholes and data loggers on selected boreholes), and by speeding up invasive alien plant removal.

h. A study should be undertaken by the DWAF to investigate and assess the implications and costs of implementing the ecological Reserve on existing water resource schemes.

i. A WCWSS information system should be developed that will assist in promoting a co-ordinated monitoring effort on various aspects of the WCWSS; this could include data sharing, quality control, and addressing gaps in data collection and reporting.

j. The Scenario Planning process should be updated on a regular basis to cater for:

- Revised future water requirement projections.
- Updated information on the implementation of the ecological Reserve and the potential for climate change.
- Updated information from recently completed studies (reconnaissance level, pre-feasibility level and feasibility level) for WC/WDM and supply-side interventions.
- Any other change to the input data.
- Revision to the CCT’s 8-year WC/WDM strategy.

k. Ongoing awareness-raising, capacity building and information sharing is required for the interested parties representing civil society, ensuring a common vision and enhanced water conservation and holistic resource management.

l. The final selection process, to select which interventions will be implemented after the BWP, needs to be based on credible refinement of information and knowledge through additional studies, so that selected interventions can be compared on a common basis.

Specific recommendations related to the selection of interventions

m. The CCT's 8-year WC/WDM strategy and programme should be implemented, to ensure that there is no shortfall prior to the implementation of the next intervention.

n. The CCT should initiate a feasibility study to determine the potential of additional longer term WC/WDM interventions to be implemented, beyond the existing 8-year strategy. Table E1 contains a summary of the study start dates for the WC/WDM intervention studies.

Table E1 Recommended Start Dates for Water Conservation and Demand Management Intervention Studies

Intervention	Date Study to Start	Study Level Required	Responsibility
CCT 8-year WC/WDM Strategy and Programme	2007	To be implemented	CCT
Longer term WC/WDM Interventions			
WC/DM: Adjustment of water tariffs, metering and credit control	2007	Feasibility (yields to be updated)	CCT
WC/DM: Eliminate auto-flush urinals	2007	Feasibility (yields to be updated)	CCT
WC/DM: Leakage detection and repair	2007	Feasibility (yields to be updated)	CCT
WC/DM: Promotion of private boreholes and wells	2007	Feasibility (yields to be updated)	CCT
WC/DM: Use of water efficient fittings	2007	Feasibility (yields to be updated)	CCT
WC/DM: User education	2007	Feasibility (yields to be updated)	CCT

o. Studies at an appropriate level of detail should be carried out for all the supply-side interventions listed in Table E2.

p. More information is required on certain interventions (specifically in terms of yield and cost) to assess their viability. Interventions where very little data exists should be studied at reconnaissance level, so that a comparative evaluation can be made in the future. These interventions are listed in Table E3.

q. The CCT should proceed with the TMG Aquifer feasibility study and pilot project, as the TMG Aquifer has been identified as a potentially significant water source for future development.

r. The CCT should proceed with the implementation of a pilot sea water desalination plant in order to learn lessons for the implementation of large-scale desalination. It is important to understand the pre and post-treatment processes, obtain a better understanding of the actual operating and capital costs associated with desalination, as well as any potential environmental impacts. The CCT should also monitor sea water quality along the Western Cape Coastline in order to develop a database of the varying sea water qualities.

s. The CCT and all other WSAs in the WCWSS should develop integrated treated effluent policies for their areas of jurisdiction and also initiate feasibility studies to determine the full future potential for the use of treated effluent in their respective areas. There should be close collaboration and integration between all the WSAs in this regard, where appropriate. This would include the conceptual design of various treated effluent use interventions, and a comprehensive EIA.

Table E2 Summary of Supply-side Intervention Study Start Dates

Intervention	Date Study to Start	Study Level Required	Responsibility
Existing Feasibility Studies/Projects			
TMG Aquifer Feasibility Study	Ongoing	Feasibility	CCT
Pilot Desalination Plant	Ongoing	Feasibility	CCT
TMG Regional Monitoring	Ongoing	Monitoring	DWAF
Invasive alien plant clearance	Ongoing	Ongoing	DWAF
Planned Future Studies			
Voëlvlei Phase 1 (1)	2007	Update feasibility	DWAF
Michell's Pass Diversion	2007	Pre-feasibility/Feasibility (2)	DWAF
Newlands Aquifer	2007	Pre-feasibility	CCT
Cape Flats Aquifer	2007	Feasibility	CCT
West Coast Aquifer Recharge (Langebaan Road Aquifer)	2007	Pre feasibility	DWAF
Upper Wit River Diversion	2007	Pre-feasibility	DWAF
Raising Steenbras Lower Dam (including pre-feasibility of Upper Campanula Dam)	2007	Pre-feasibility	DWAF/CCT
Lourens River Diversion Scheme	2007	Update Pre-feasibility (as linked to Raising Steenbras Lower)	CCT/DWAF
Upper Molenaars Diversion	2007	Pre-feasibility	DWAF
Effluent Re-use (policy, effluent treated to potable standards, effluent treated for irrigation/industry use)	2007	Pre-feasibility	CCT and all WSAs
WCWSS Use of Treated Effluent Study	2007	Pre-feasibility	DWAF

Notes :
1. This would include a pre-feasibility study of the Voëlvlei Phase 2 Scheme.
2. Michell's Pass Diversion may have to be carried out at feasibility level to make a comparison with Voëlvlei Phase 1.

Table E3 Summary of intervention where insufficient information is available

Intervention	Timing	Responsibility
Groundwater		
Conjunctive use	To be determined by Strategy Steering Committee	DWAF
Artificial Recharge (ASR)	To be determined by Strategy Steering Committee	DWAF
Artificial Recharge: Breede River Alluvium	To be determined by Strategy Steering Committee	DWAF
Maximise existing infrastructure		
Steenbras Pumped Storage Scheme Intake	2007	CCT
Possible additional off-channel raw water storage at Misverstand Dam	To be determined by Strategy Steering Committee	DWAF
Maximise WCWSS yield		
Operation of Kleinplaas Dam	2007	CCT
Improve Management of Atlantis Aquifer (see Note 1)	2007	CCT

Intervention	Timing	Responsibility
Other		
Implications of implementing ecological Reserve on existing water resources	To be determined by Strategy Steering Committee	DWAF
Water Trading	As soon as possible	All WSAs
Non-flow Related Interventions	To be determined by Strategy Steering Committee	DWAF
Integrated Catchment Management	To be determined by Strategy Steering Committee	DWAF
Integrated WSWSS Re-use of Water Study (including Berg River water exchange)	2007	DWAF
Note 1: Improved management and operation of the Atlantis Aquifer will reduce the reliance placed on Voëlvlei Dam		

t. The DWAF should initiate an integrated WCWSS treated effluent use study, which would include interventions such as the exchange of Berg River irrigation water.

u. The Strategy Steering Committee should monitor the progress of the CCT's TMG Aquifer Feasibility Study and Pilot Project and, after considering the outcomes, take a decision regarding further feasibility studies on the TMG Aquifer Scheme.

v. The capacity of the Voëlvlei bulk supply pipeline should urgently be assessed by the CCT, as the condition of this pipeline may impact on the viability of implementing either the Voëlvlei Phase 1 Scheme or the Michell's Pass Diversion Scheme. The cost implications on other supply-side interventions, utilising an additional pipeline from Voëlvlei to the CCT, should be assessed.

w. Owing to the potential impact of climate change on the reconciliation of water supply and requirement, the DWAF should initiate an impact assessment study in this regard.

The Strategy Committee

A number of organisations currently own, operate and receive water from the WCWSS. The main role-players to date have been the DWAF, CCT and the Provincial Department of Agriculture. Although these organisations would continue to play a significant role in future decisions, other organisations need a forum to ensure that their requirements can be clearly conveyed, that they can make contributions when needed, and that they are continuously informed about the development and decisions regarding the WCWSS.

Therefore it is proposed that a Strategy Steering Committee is formed with a clearly defined mandate and scope of work. This will require that various memorandums of understanding be developed, defining the responsibilities of the various organisations and spheres of government. The Strategy Steering Committee should also be provided with an administrative and technical Support Group that should be established.

The following functions are proposed for the Strategy Steering Committee:

1. To ensure that the Reconciliation Strategy is relevant and updated,
2. To monitor and co-ordinate the implementation of the relevant actions identified in the Reconciliation Strategy, and

3. To make recommendations on long-term planning activities required to ensure reconciliation of the water requirement and available supply in the WCWSS supply area (i.e. recommending feasibility studies of particular interventions to ensure timely implementation).

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
Directorate National Water Resource Planning
WESTERN CAPE WATER SUPPLY SYSTEM RECONCILIATION STRATEGY
Summary Report

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ABBREVIATIONS AND ACRONYMS

AFU	Automatic Flush Urinals
AsgiSA	Accelerated Sustained Growth Initiative for South Africa
BWP	Berg Water Project
CWDM	Cape Winelands District Municipality
CCT	City of Cape Town
CMA	Cape Metropolitan Area
CMC	Cape Metropolitan Council
CT	Cape Town
DWAF	National Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
GWS	Government Water Scheme
HIV/Aids	Human Immune Virus/Acquired Immune Deficiency Syndrome
HWR	High Water Requirement
IAP	Invasive Alien Plants
I&AP	Interested and Affected Parties
IDP	Integrated Development Plan
IFR	Institute of Futures Research
IWRP	Integrated Water Resource Planning
LWR	Low Water Requirement
NPV	Net Present Value
NWA	National Water Act
O&M	Operation and Maintenance
RDM	Resource Directed Measures
RO	Regional Office of DWAF in the Western Cape
RPST	Reconciliation Planning Support Tool
RQO	Resource Quality Objectives
RSE	Riviersonderend
TCTA	Trans Caledon Tunnel Authority
TMG	Table Mountain Group
UAW	Unaccounted for Water
URV	Unit Reference Value
WC	Water Conservation
WC/WDM	Water conservation and water demand management
WCRSS	Western Cape Reconciliation Strategy Study
WCSA	Western Cape Systems Analysis
WCWSS	Western Cape Water Supply System
WDM	Water Demand Management
WMA	Water Management Area
WMS	Water Management System
WRC	Water Research Commission
WRM	Water Resource Management
WRU	Water Re-use
WRPM	Water Resource Planning Model
WRYM	Water Resource Yield Model
WSA	Water Service Authorities
WSDP	Water Services Development Plan
WTW	Water Treatment Works
WUA	Water User Association
WUE	Water Use Efficiency
WWTW	Waste Water Treatment Works

TERMS USED

Additional WC/WDM interventions	Longer-term WC/WDM interventions that are not included in the CCT WC/WDM strategy and programme. The information was based on the Integrated Water Resource Planning Study, which was completed in 2001.
CCT's WC/WDM strategy and programme	WC/WDM interventions contained in the CCT's WC/WDM strategy and 8-year programme. The CCT's WC/WDM strategy and programme is in draft format and still requires formal acceptance and adoption by the CCT.
Feasibility Study	A detailed study including engineering, economic, social, environmental and other aspects. The study, which includes a full EIA process, is aimed at enabling a final decision regarding the viability of implementing the intervention to be made.
Implementation programme	The time required to implement each intervention taking consideration of the various approval processes required, the study lead-time and the construction period.
Intervention	A supply scheme, operational measure, or WC/WDM option that provides addition yield to the system or reduces the water requirement of the system.
Net Present Value (NPV)	The current-day operating and maintenance costs associated with the implementation of an intervention.
Pre-feasibility Study	A study required to evaluate a number of alternative options (for the implementation of a specific intervention) in more detail, so that sufficient information is made available to make a reliable selection between options.
Reconciliation Planning Support Tool	A graphical planning support tool used to assist in making decisions on how best to meet the future water requirement. The tool allows the user to compare potential interventions with one another, and with one or more selected future water requirement scenarios.
Reconnaissance Study	A study required to provide sufficient information to assess whether an intervention should be considered for further study. A Reconnaissance Study is therefore normally required before an intervention can be meaningfully compared in the Reconciliation Planning Support Tool.
Scenario	A combination of interventions that are selected to meet the water supply requirement of the system.
Study start date	The date on which a study should be initiated in order for the intervention to be ready for implementation when needed.

Water Conservation and Water Demand Management (WC/WDM)	Water Conservation focuses on the protection and efficient use of water resources. Water Demand Management focuses on achieving the most beneficial and efficient solution to water services from various perspectives, including social and financial. This term comprises both components.
Yield	The maximum quantity of water obtainable on a sustainable basis from a dam(s), river or groundwater source in any hydrological year (at a certain level of risk), and under specified conditions of catchment development and system operation.

1. INTRODUCTION

1.1 The need for a Strategy

It is anticipated that a positive population growth and a strong economic growth within all sectors of the Western Cape will lead to an increase in the future water requirement from the Western Cape Water Supply System (WCWSS, also hereafter referred to as "the System"). Even with the Berg Water Project in place and with the implementation of the City of Cape Town's (CCT) water conservation and demand management interventions, the yield (available water) of the System will only meet the expected requirements until about 2015; thereafter additional interventions will be required to either augment the yield or to reduce the water requirement.

The existing yield of the WCWSS may also be impacted on by the implementation of the ecological Reserve and by possible climate change. These factors will influence the date upon which an additional intervention(s) will be required in order to reconcile supply and requirement.

In early 2005, the Department of Water Affairs and Forestry (DWAF), as the custodian of the country's water resources, in partnership with the CCT, commissioned the Western Cape Reconciliation Strategy Study (WCRSS) to facilitate the reconciliation of predicted future water requirements with supply from the Western Cape Water Supply System (WCWSS) for a 25 year planning horizon.

One of the main objectives of the Study was to design a defendable, documented process for the selection of interventions to ensure the ongoing reconciliation of the water supply and requirement until 2030. In addition to the main objective, the Study also served the following purposes:

- To engage stakeholders and the general public in the management of regional and local water resources,
- To develop toolkits to assist with the future reconciliation of supply and requirement,
- To provide a guide for decision-making towards effective reconciliation of supply and requirement, and
- To recommend preparatory measures and actions and assign responsibilities.

1.2 Outcome of the study

The Strategy outlines the approach, actions and responsibilities, across nine broad themes (see Figure 4.1 and Section 5), necessary to ensure ongoing reconciliation between water requirement and supply. The Strategy covers all current and future strategic activities required in the reconciliation process and it is supported by four technical study reports. This report presents a summary of the Strategy and briefly addresses the supporting technical reports.

Box 1.1: WCRSS Vision

Achieving reconciliation of water supply and requirement for the DWAF, CCT, local authorities and urban and agricultural water users in a water-scarce area. To supply water at adequate levels of assurance within the constraints of affordability and at appropriate levels of service to users, whilst ensuring protection of current and potential future resources, and the efficiency of the operation and management of the WCWSS, in an integrated and sustainable manner.

The study selection process, described in the Strategy, provides a framework that can be used to ensure the ongoing reconciliation of water supply and requirement. This study selection process undertaken as part of this study process undertaken as part of this study provided a list of interventions which should be studied further, to ensure the reconciliation of water supply and requirement over the longer term.

The vision of the Strategy is contained in Box 1.1.

1.3 Planning Framework

In terms of the Water Services Act (Act 108 of 1997) all water services authorities (municipalities) are required to prepare a Water Services Development Plan (WSDP).

The WSDP is a sectoral business plan which sets out the way in which the water services authority (WSA) plans and delivers services to individuals and businesses in its area of jurisdiction. It also describes and analyses the current and future consumer profile, the type of services which are provided, the infrastructure requirements, a water balance, organisational and financial arrangements to be used, an assessment of the viability of the approach, and an overview of environmental issues. The strategic issues arising from the WSDP form the basis for input into the Integrated Development Plan (IDP) process. A Water Conservation and Water Demand Management Strategy is also a key component of the WSDP. The Reconciliation Strategy, which is also a key component of the WSDP, informs the WSDP on the following issues:

- Future water requirements;
- Balance between available yield and future water requirement;
- Interventions which could be implemented in order to ensure the reconciliation of water supply and requirement till 2030; and
- Actions which should be taken to ensure the ongoing reconciliation of water supply and requirement.

The WSDPs of all the WSAs in the Western Cape Province in turn inform the Provincial Integrated Development Plan. The Reconciliation Strategy will also inform the Berg and Breede-Overberg Catchment Management Strategies.

Figure 1.1 below depicts diagrammatically how the Reconciliation Strategy fits into the planning process.

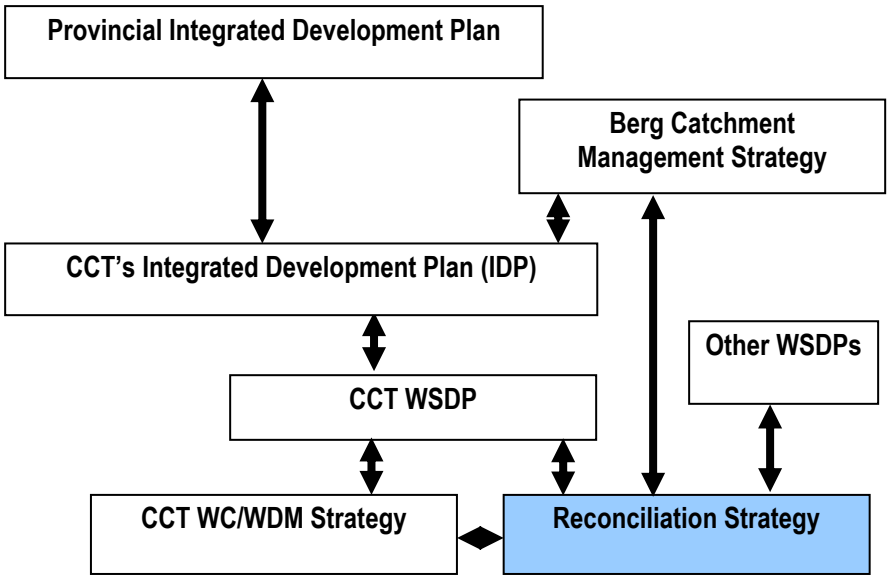

Figure 1.1 Planning Framework in the Water Services Sector

1.4 Previous Studies

The Reconciliation Strategy builds upon the Western Cape System Analysis study (WCSA), undertaken by DWAF and the CCT between 1989 and 1995. The purpose of the WCSA was to "provide a detailed decision support facility to assist in the optimal future development of the water supply to the Greater Cape Town Metropolitan Area and its environs". In 1996, the options identified by the WCSA underwent a process of public involvement and twelve schemes were identified for further study. All of the options identified in the WCSA have subsequently been studied further, by either the CCT or DWAF, and were included as interventions in this Study (see Box 1.2).

Box 1.2: Interventions identified for further study in the Western Cape System Analysis

- Water Demand Management
- Alien Vegetation Clearance
- Michell's Pass Diversion
- Eerste River Diversion
- Voëlvlei/Lorelei 1
- Lourens River Diversion
- Cape Flats Aquifer
- Skuifraam Dam
- Skuifraam Supplement
- Direct Re-Use of Sewage Effluent
- Sewage Effluent Exchange
- Desalination of Sea Water

In addition to the WCSA, a large number of interventions included in the Study were identified through previous studies. These studies include the following:

- The CCT's Integrated Water Resources Planning (IWRP) Study. The aim of the IWRP Study was to investigate various water demand management initiatives at pre-feasibility level, along with various water supply augmentation schemes. The study considered the technical, institutional, socio-economic, environmental and financial aspects of the options using a multi-criteria decision making analysis. The results of the IWRP Study indicated that a significant reduction in water demand could be achieved through the implementation of recommended water demand management initiatives. In comparison to the water supply options, the recommended water demand management initiatives would have a significantly lower implementation cost, could be implemented in a shorter time frame and were generally more environmentally and socially acceptable. The IWRP Study also informed the CCT's WC/WDM Strategy;
- The CCT's Water Conservation and Water Demand Management (WC/WDM) Strategy and Programme;
- The DWAF has conducted a number of studies that identified various schemes, including the Voëlvlei Dam First Phase Feasibility Study, the Breede River Basin Study and the West Coast Study;
- CCT is currently undertaking the Table Mountain Group (TMG) Aquifer Feasibility and Pilot Wellfield Project;
- A study concerning the positioning of a pilot seawater desalination plant for Cape Town has recently been completed by the CCT; and
- A study undertaken by BVi Consulting Engineers on treated effluent re-use within the City of Cape Town.

2. THE WESTERN CAPE WATER SUPPLY SYSTEM

2.1 Background

The WCWSS serves more than 3 million people and provides water to the communities of CCT and certain Overberg, Boland, West Coast and Swartland towns, as well as the irrigators along the Berg, Eerste and Riviersonderend Rivers. Urban use within the CCT is the largest water use from the WCWSS.

The area currently supplied with water from the WCWSS has been included in the Study, as well as potential sources of future supply and areas that may be affected by the interventions identified in this strategy. The geographical area to which the strategy currently applies is shown in **Figure 2.1**.

The largest proportion of water in the system is supplied to urban users, both domestic and industrial (63% in 2004) within the CCT. A much smaller proportion of water (5% in 2004) is supplied to the towns of Stellenbosch, Paarl and Wellington, as well as to towns on the West Coast and in the Swartland region. Some urban users in the Riviersonderend catchment, in the Breede Water Management Area (WMA) as well as rural users, also receive water from the system for stock watering and domestic use. In 2004, approximately 32% of the total volume of water supplied by the WCWSS was used by irrigators along the Berg and Eerste Rivers and along the Riviersonderend in the Breede WMA.

Box 2.1 describes a number of local urban supply schemes that supplement the WCWSS.

Box 2.1: Local supply schemes that are supplemented from the WCWSS

- *Table Mountain and Southern Peninsula Schemes* supplements the supply from Theewaterskloof, Steenbras and Wemmershoek Dams as well as that from the Palmiet transfer.
- *Atlantis Groundwater Scheme* supplies the towns of Atlantis and Mamre from two well fields at Witsand and Silverstroom. This area is also supplied from Voëlvlei Dam.
- *Paarl* supplements its water via winter pumping from the Berg River into two off-channel storage dams (Nantes and Bethel), in addition to the supply from Wemmershoek Dam.
- *Stellenbosch* Excess winter water is abstracted from the Eerste River and stored in the two Idas Valley dams for use during summer. During dry summers, Stellenbosch's water supply is supplemented from Theewaterskloof Dam.

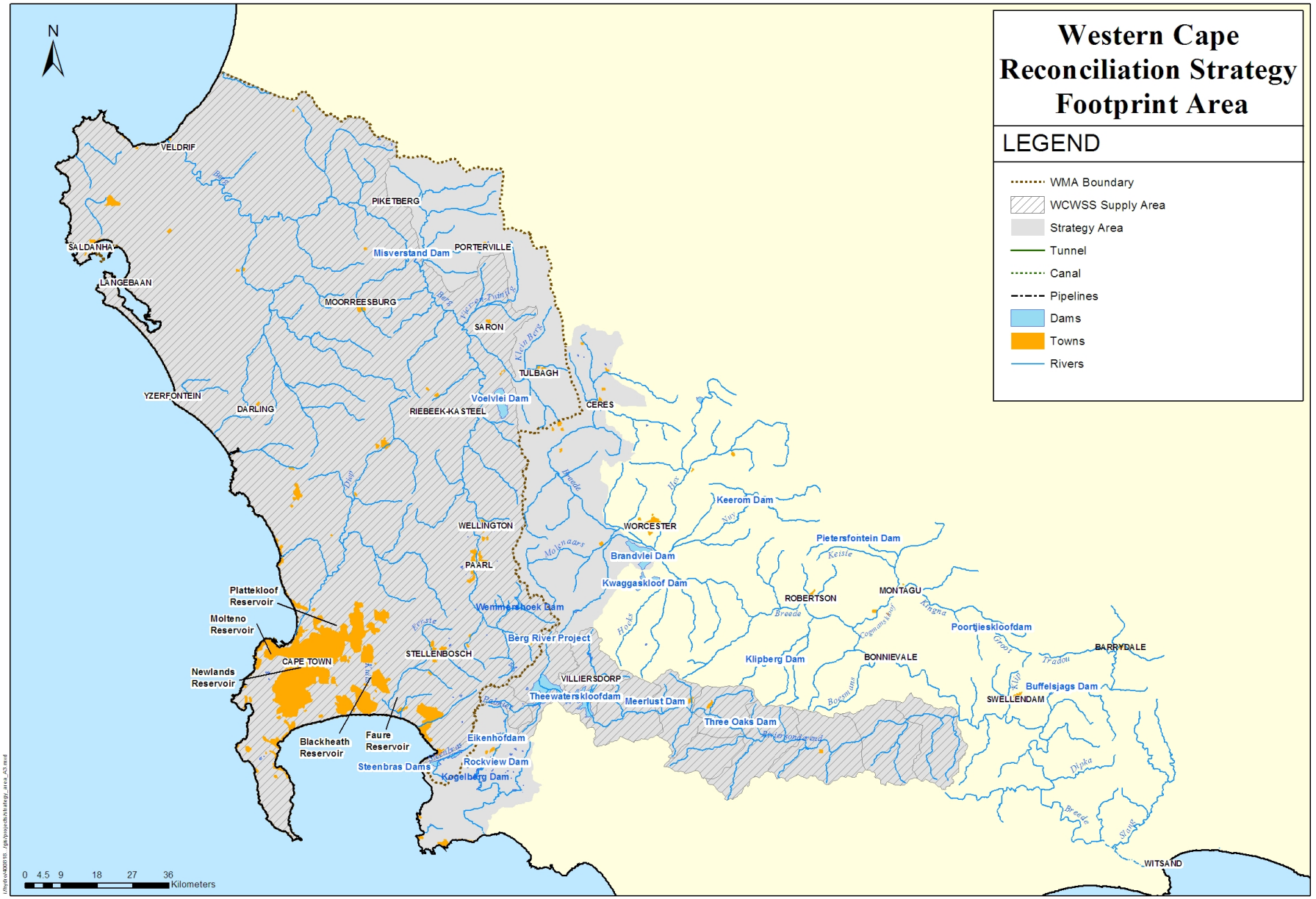

Figure 2.1 Geographical extent of Reconciliation Strategy area

2.2 The main dams and infrastructure

The main storage dams of the WCWSS are the Theewaterskloof and Voëlvlei dams (owned and operated by the DWAF), and the Wemmershoek, Upper Steenbras and Lower Steenbras dams (owned and operated by the CCT). These dams supply raw water to the CCT, other local authorities and irrigators in the catchments of the Riviersonderend, Berg and Eerste rivers. The largest supply scheme of the WCWSS is the Riviersonderend Government Water Scheme (GWS), which is a large inter-basin water transfer scheme that regulates the flow of the Riviersonderend (RSE), Berg and Eerste rivers, for urban, industrial and irrigation use. The RSE GWS consists of the Theewaterskloof Dam on the Riviersonderend River and a tunnel system through the Hottentots Holland Mountains. This tunnel system conveys surplus flows in winter from the Berg River tributaries to the Theewaterskloof Dam where the water is stored. In summer, water is released back via the RSE tunnel system to the Franschhoekberg outlet, the Kleinplaas Dam on the Eerste River, and the Stellenboschberg outlet. The Berg River Dam is linked to this scheme via the Dasbos outlet. Pipelines from the RSE GWS and the other dams convey water to the water treatment plants which supply the City of Cape Town and surrounds with potable water.

It is the relatively large capacity of DWAF's tunnel system and of the CCT's pipelines from these dams, as well as the flexibility of the CCT's bulk water supply system, that enables all the major dams to be operated as an integrated system. The purpose of operating the dams as an integrated system is to prevent unnecessary spillage from any one dam, and thereby maximise water resources to the benefit of all water users.

Figure 2.2 illustrates the percentage contribution the major supply dams in the WCWSS make to the combined yield of the system.

The estimated replacement values of the bulk water supply and reticulation infrastructure, supplying some 310 million m^3/a to CCT for urban and industrial use, and of the corresponding wastewater infrastructure are approximately R16.5 billion and R6.5 billion respectively, i.e. a total of about R23 billion. High levels of expertise and skills are required to plan, manage and maintain these essential and valuable assets.

2.3 The Berg Water Project

The Berg Water Project (BWP), scheduled for completion in 2007, will also form part of the WCWSS. This project will meet the growing water requirement until 2011; thereafter additional demand and supply interventions will be required. The BWP will initially be owned by the Trans Caledon Tunnel Authority (TCTA) and upon completion of the loan repayment period be transferred to the DWAF.

2.4 Operation of the Western Cape Water Supply System

The WCWSS is situated in a winter rainfall area, characterised by wet winters and dry summers, and the dams are therefore filled during the wet winter months, from May to October, when about 90% of the annual runoff occurs. During this period the water requirement comprises only about 30% of the annual requirement. During the dry summer months, from November to April, inflows to the dams are small and irrigation and garden watering requirements in the urban areas are large. Approximately 50% of the dams' storage volumes are required for storage during the winter so that the high water requirement during the summer can be met. The remaining 50% of the dams' storage volume is required to provide long-term carry-over storage for periods of drought.

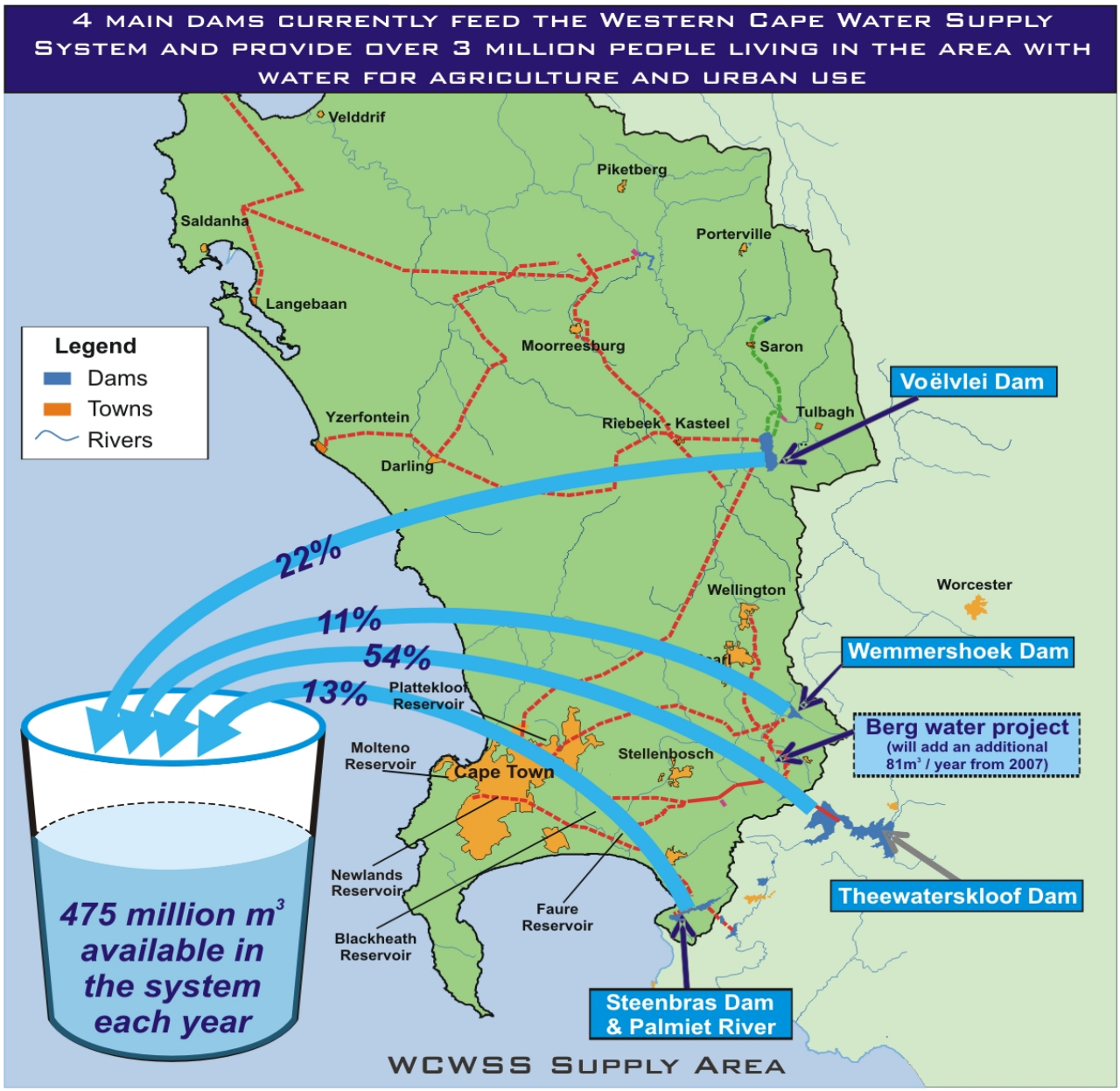

Figure 2.2 Percentage contribution of the major dams to the yield of the WCWSS

The dams are operated in an integrated manner to minimise spillage during the wetter years and thus to maximise the stored water available for essential use during droughts. The effects of droughts are assessed with the DWAF's water resources system model and are managed by progressively restricting supplies. The Director General of the DWAF imposes these restrictions after consultation with all Water User Associations (WUA) and water service providers and authorities. The DWAF's Regional Office and CCT co-operatively manage the WCWSS.

3. WATER REQUIREMENTS

3.1 Current Requirements

The highest recorded unrestricted water use of users within the WCWSS area to date is 499 million m^3/a (in CCT's 1999/2000 financial year). The total unrestricted water use from the WCWSS in 2006 was estimated to be 465 million m^3/a.

The sectoral water use pattern for 2006 was as follows:

Urban:	310 million m^3/a (67% of the total)
Irrigation estimated:	154 million m^3/a (33% of the total)
TOTAL	465 million m^3/a

Historical water use by the CCT is marked by stepped declines between 1976 and 1977 and again between 1995 and 1996. In the year 2000, the water requirement from the system totalled 499 million m^3/a. Due to below average winter rainfall in 2000, the DWAF imposed 10% restrictions (10% curtailment of water demand required) on all water users. The 2000 restrictions resulted in a reduction in water use by the urban sector, followed by a progressive return to the relatively higher water usage levels by 2004 (476 million m^3/a). A severe drought was experienced during the winters of 2003 and 2004 and after consultation with all the water users, the DWAF imposed 20% water restrictions. Towards the end of 2005, after a winter of above average rainfall, DWAF relaxed the water restrictions to a 5% restriction and encouraged all water users to try to save an additional 5%.

Historically, the annual water requirement has generally increased consistently over time, with the exception of the restriction periods experienced post 2000. The historical water requirement is shown in Figure 3.1.

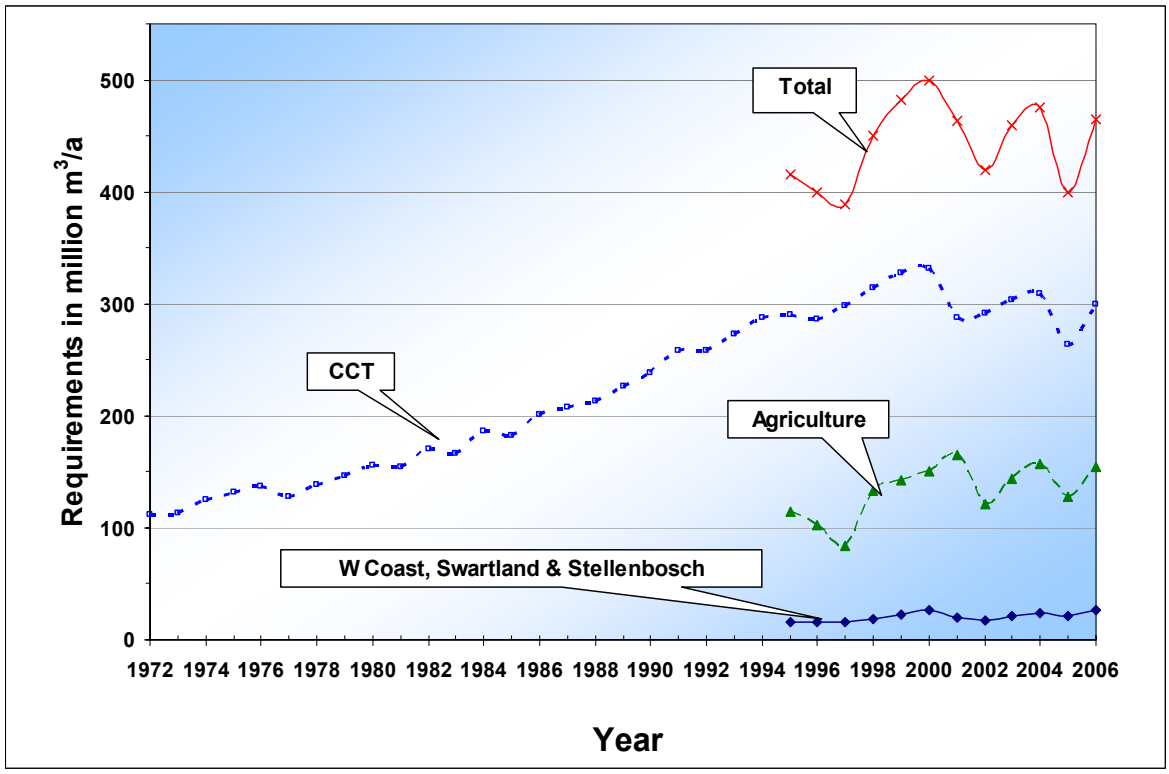

Figure 3.1 Historical water use within the WCWSS

Current allocations to the agricultural sector are not fully utilised at present. This is in part because the high-value crops, such as deciduous fruit trees and vines, require a high level of assurance of water supply in order to produce the quality and size of fruit the export market dictates. Many irrigators do not utilise their full irrigation allocations every year (as current agreements allow them), but rather manage their water to obtain the same higher assurance of supply as urban users during drought years.

The agricultural sector can if they wish continue to "grow" until they reach their "capped allocation". During compulsory licensing, the DWAF will license the agricultural sector based on their historic maximum water use, up to that point in time (provided the agricultural usage do not exceed their capped allocation). A detailed record of the allocations of all the water users within the WCWSS is contained in Annexure B of the Reconciliation Strategy Report.

3.2 Future Requirements

The Western Cape Reconciliation Strategy Study (WCRSS) was commissioned to ensure a balance between the future water requirement and the supply of the WCWSS. The future water requirement is an estimation of future water use derived through the modelling of predicted urban and agricultural water use, that reflect different economic and population growth scenarios.

Updated future water requirement scenarios were developed as part of the WCRSS using an updated water requirement forecast model. The model is based on the historic trends in terms of water demand, population and economic growth rates. The model was developed to estimate the growth in bulk water requirement for the CCT as this is where the main growth is anticipated, although outside of the Greater Cape Town area, the CCT supplies bulk water to Drakenstein and Stellenbosch municipalities. The model includes a percentage increase in bulk water supplies to these municipalities. Two future water requirement scenarios were developed, namely a High Water Requirement scenario and a Low Water Requirement scenario. These two water requirement scenarios are discussed in more detail in Section 5.1.

3.3 Reconciliation of Supply and Requirement

The total present water use within the WCWSS area is estimated at about 465 million m^3/a. The existing sources of the WCWSS can yield about 475 million m^3/a (at a risk of failing on average once in 50 years to supply this full requirement). During periods of drought, such as occurred in 2000 and during the winters of 2003 and 2004, water restrictions are introduced to reduce the requirement on the system. From 2007 onwards, the BWP will increase the availability by about 81 million m^3/a, increasing the total availability to 556 million m^3/a, and therefore water restrictions are not likely to be required during the following few years, under average runoff conditions.

If the water requirement grows as projected for the High Water Requirement curve then the total requirement will increase to an estimated 560 million m^3/a by 2011, with the implication that

Difference between drought mitigation and water conservation and demand management

There are fundamental differences between drought mitigation and WC/WDM interventions and one must not confuse water restrictions with water demand management. Water restrictions are planned punitive measures to reduce water demand in the short term and should be applied judiciously when circumstances such as droughts necessitate the implementation thereof. WC/WDM focuses on the sustained minimisation/ elimination of wastage and the optimal use of water over the medium to long-term, with nominal impact on the quality of life of the consumer and invariably with financial benefits accruing to the municipality concerned.

the system supply will be fully utilised. With the implementation of the WC/WDM interventions contained in the CCT's draft WC/WDM strategy (2006), the requirement for further interventions could be delayed until 2015. Without implementation of the WC/WDM interventions, 2011 is likely to be the key milestone date for implementation of the next intervention, to reconcile requirement and supply. When the requirement exceeds the available supply, all the processes for implementing the next intervention would have to be completed, including the selection process, feasibility studies, obtaining the necessary approvals, and all the actions and procedures necessary for actual implementation, which may require design and construction. Any delays in these processes are likely to result in the supply exceeding availability and the need for increasingly frequent water restrictions.

4. WESTERN CAPE RECONCILIATION STRATEGY

4.1 Background

A stakeholder workshop to obtain buy-in and guidance on the strategy content, composition and format was held on 25 January 2006. After a series of working sessions by the Technical Focus Group (including officials from the DWAF, CCT, Western Cape Provincial Department of Agriculture and the consultant team), a draft strategy was developed. Nine strategic themes, which encompass current and proposed future activities to address the various key issues, were identified and developed. Each theme describes the issues, approach, activities and responsibilities that are required to support the decision-making process. Timely preparatory measures, assignment of roles and responsibilities and consequent actions are required to ensure implementation of appropriate interventions. Figure 4.1 diagrammatically illustrates the nine themes contained in the Reconciliation Strategy.

The Strategy supports an adaptive approach to water resource management and is a living document, to be continuously improved as estimates of water requirement, water availability and resource development options become better understood and are more reliably quantified.

Figure 4.1 Themes contained in the Reconciliation Strategy

4.2 Development of the Strategy

The public has been engaged throughout the process of developing the Strategy. The engagement has taken the form of press releases, newsletters, public meetings and presentations of the Strategy to both the Berg and the Breede Overberg CMA Reference Groups. A copy of the draft Strategy has also been available on Ninham Shand's website since September 2006. Table 4.1 summarises the main dates and objectives of communication with interested and affected parties (I&APs) and through public meetings and newsletters.

Table 4.1 Summary of Public Meetings and Newsletters

Public meeting no	Date	Venue	Objective
Newsletter 1	May 2005	Distributed to all I&APs	Introduction to Study
Public meeting 1	31 May 2005	Velddrif Town Hall	Introduction to Study
Public meeting 1	1 June 2005	Bellville Civic Centre	Introduction to Study
Public meeting 1	2 June 2005	Paarl Town Hall	Introduction to Study
Newsletter 2	October 2005	Distributed to all I&APs	Feedback on preliminary screening workshop
Public meeting 2	24 November 2005	Durbanville Town Hall	Feedback on preliminary screening workshop
Newsletter 3	November 2006	Distributed to all I&APs	Overview of draft Strategy
Public meeting 3	19 July 2007	Durbanville Town Hall	Overview of final Strategy
Newsletter 4	July 2007	Distributed to all I&APs	Overview of final Strategy

In early 2006, a framework Strategy was presented to the Project Steering Committee. Comments and suggestions were integrated into the Strategy and additional tools, such as the Reconciliation Planning Support Tool (RPST or "Planning Tool"), were developed. Copies of the Draft Strategy were then circulated to a wider group for review in September 2006. This included the DWAF, CCT, Steering Committee members and the Berg and Breede-Overberg CMA Reference Groups. Presentations of the Draft Strategy were also made to the Berg and Breede-Overberg CMA Reference Groups. Thereafter, a series of Technical Focus Group workshops were held between August and October 2006. The objective of the Focus Group was to develop approaches to implementing the activities outlined in the Draft Strategy. The implementation tables in the Strategy present the outcome of these Focus Group workshops and include the actions, responsibilities and programme for addressing key issues in each theme. The Strategy presented here also includes the revisions to the Draft Strategy, based on the feedback obtained from the Steering Committee and engagement with stakeholders.

The study selection process described in the Strategy (refer to Section 6 of this Report) was carried out during the Study and a list of proposed interventions has been developed for further study to be able to ensure the reconciliation of water supply and requirement. These interventions are summarised in the recommendations to this Report and were presented to the public for comment at a final public meeting in July 2007. Any comments received from the public will be taken forward by the Strategy Steering Committee and will be taken into account in the further development and updating of the Strategy.

5. OVERVIEW OF THE RECONCILIATION STRATEGY THEMES

The following section provides a brief summary of the objective, background, and recommendations developed for each theme in the Strategy.

5.1 Water Requirements

5.1.1 Background

During 2004/2005, the CCT updated their estimated future urban water requirement from the WCWSS. This study was called "City of Cape Town: Review of the Long-Term Urban Water Demand" and made use of population projections up to 2015. The model developed during that study was based on several parameters with the primary inputs being population growth and economic growth. Updated future water requirement scenarios were developed as part of the WCRSS using an updated water requirement forecast model. The water requirement scenarios were dictated by the following assumptions:

- Forecasted economic growth rates
- Forecasted population growth rates
- The base year (start date for forecasting).

Population growth rates declined between 1972 and 2001 due to HIV/Aids, the out-migration of working-age residents and a decline in fertility rates, whereas the economic growth from 1996 to 2006 was higher than the national average, but lower than that of other South African metropolitan areas. In accordance with the Institute of Futures Research (IFR) recommendations, a low economic growth rate of 4% was used in the model. A high economic growth rate of 4.5% was used for the period 2006 to 2010 and the AsgiSA 6% growth rate was used for the remainder of the period. For the period 1996 to 2006, the growth rate in water requirements was found to be lower than the economic growth rate, but higher than the population growth rate.

Two future water requirement scenarios were developed using the water requirement forecasting model. For the High Water Requirement scenario, with high economic and population growth, the total system requirements would grow from 502 million m^3/annum in 2006, to 935 million m^3/annum in 2030, and for the Low Water Requirement scenario from 465 million m^3/annum in 2006 to 670 million m^3/a in 2030. These scenarios did not take account of water conservation and demand management, as these are included as interventions that could be selected to reduce the future water requirement.

The anticipated population and economic growth rates, up to 2030, as well as the resultant average growth in water requirement are shown in Table 5.1 below.

Table 5.1 Anticipated population and economic growth rates

Water requirement scenario	Average growth in water demand (%)	Population growth rate (% per annum)			Economic growth rate (% per annum)	
	2006 – 2030	2006-2011	2011-2016	2016-2030	2006-2010	2010-2030
High	3.09	1.12	1.38	1.74	4.5	6
Low	1.43	0.16	0.36	0.70	4	4

The anticipated growth in urban water requirement, combined with the anticipated growth in agricultural requirement, provides the anticipated total future water requirement on the WCWSS. Figure 5.1 illustrates the anticipated high and low water requirements placed on the system. It was decided to use 2003 for the base year for the high water requirement (pre- 20% water restrictions) and 2006 as the base year for the low water requirement (post- 20% water restrictions).

It must be noted that predicting future water requirements from 1999/2000 is complicated by the fact that water restrictions were imposed in 2000/2001 and then again in 2003/2004. In parallel to this, the City continued to implement water demand management initiatives.

For additional information on the determination of future water requirements refer to the Strategy Report entitled “Determination of Future Water Requirements”.

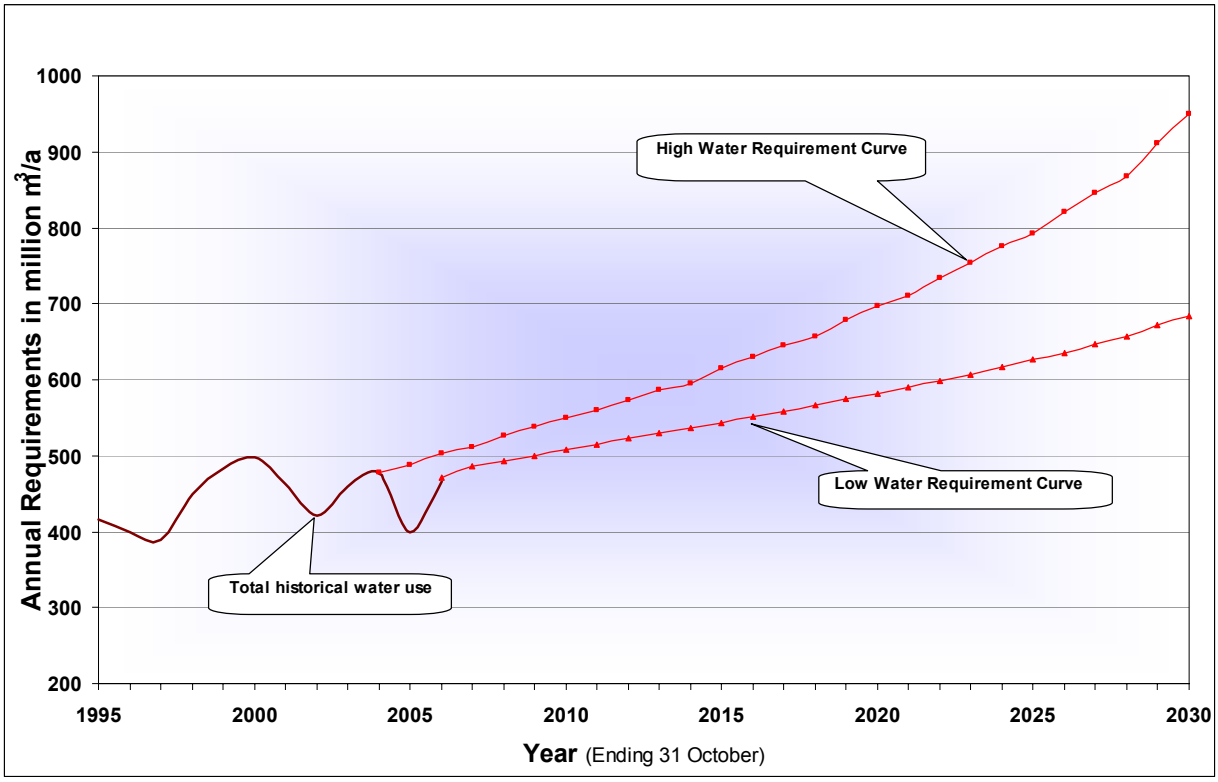

Figure 5.1 Predicted low and high water requirements scenarios

A summary of the theme objective and key issues is presented in Table 5.2. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.2 Water Requirement Theme

Objective:	*To address aspects relating to the bulk use of raw water, including estimation of future water use through the development of urban and agricultural water use scenarios, and the management of current and future allocations.*
Sub-theme:	**Water requirement scenarios**
Key issues:	a. Future urban requirement scenarios b. Future agricultural requirement scenarios

5.1.2 Recommendations

The recommendations, which arose through the development of this theme, are listed below:

- Realistic forecasting of future water requirements is an important part of the reconciliation process.
- The estimates of future water requirements for the High Water Requirement curve should be used for planning purposes.
- Monitoring, comparing and continually refining the methods of projecting future requirements is an integral part of implementing the Strategy.
- Due to the fact that restrictions are still in force, the model should be run on an annual basis to determine the impact of a change in base year demand.

5.2 Water Use Efficiency

5.2.1 Background

Water is a scarce resource in the WCWSS area and it is therefore essential to use it efficiently to ensure sustainable availability and supply into the future. The National Water Act (1998) and the Water Services Act (1997) emphasise the importance of WC/WDM in support of environmental sustainability, social-economic equity and water use efficiency. The development of a water demand management strategy is also a key requirement of the WSDP, which is required under the Water Services Act.

Water Conservation (WC) focuses on the protection and efficient use of water resources. Water Demand Management (WDM), as a component of WC, focuses on achieving the most beneficial and efficient solution to water services from various perspectives, including social and financial.

Water Conservation and Demand Management

In 1999, the CCT initiated the Integrated Water Resources Management Study, the outcome of which clearly indicated that WC/WDM interventions are the most feasible for reconciling water requirement and supply. In 2001, CCT developed a WC/WDM Policy and Implementation Strategy. Institutional restructuring and other competing priorities between 2002 and 2004 impacted on the implementation of WC/WDM initiatives. However, in 2004 a 10-point strategy, including both output and input goals, was developed in partnership with the DWAF, to augment the original 2001 WC/WDM strategy, including an 8-year budget, be developed for implementation from 2005. However, the 2004/05 drought delayed completion of the strategy, with the focus being shifted to drought mitigation measures. The WC/WDM strategy was revised in 2006 and approved by the CCT's Utility Services Portfolio Committee, the Mayoral Committee and full Council during May 2007. Several successful WC/WDM projects have already been implemented by CCT's Water Demand Management Branch, including pressure management projects, leak repair projects, treated effluent use and community awareness projects.

When the Minister of DWAF approved the construction of the BWP, the project was approved as a parallel process to the CCT implementing WC/WDM. The target set by the DWAF in terms of the Low Water Demand Curve was beaten by 13% in the CCT's 2005/06 financial year.

For more detail regarding programmes and initiatives implemented by the CCT refer to the Strategy Report entitled *Overview of Water Conservation and Demand Management in the City of Cape Town*.

Treated effluent use

At present, about 60% of all the water used by CCT enters the sewer networks as wastewater. This wastewater is then treated and either re-used (currently estimated to be about 10%) or is discharged to the sea as treated effluent (currently 90%). The treated effluent that ultimately ends up in the sea is often disposed of through rivers and vleis, with significant environmental impact. For more information regarding the use and potential treatment of effluent refer to the Strategy Reports entitled:

- Treatment of Effluent to Potable Standards for Supply for the Faure Water Treatment Plant
- Overview of Water Re-use Potential from Wastewater Treatment

A summary of the theme objective and key issues is presented in Table 5.3. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.3 Water Use Efficiency Theme

Objective:	*To address aspects relating to urban and agricultural water use efficiency, including the identification of potential water saving measures, setting targets and objectives, as well as interventions. The potable and non-potable use of treated wastewater is also addressed.*
Sub-theme:	**Urban water use efficiency**
Key issues:	a. Defining Water Conservation/Water Demand Management (WC/WDM) targets and objectives b. WC/WDM intervention options for water use efficiency
Sub-theme:	**Agricultural water use efficiency**
Key issues:	a. Improving efficiency
Sub-theme:	**Water reuse**
Key issues:	a. Potable and non-potable use

5.2.2 Recommendations

The recommendations, which arose through the development of this theme, are listed below:

- The effectiveness of WC/WDM, and water re-use, is closely linked to the commitment and capacity of the institutions implementing these measures. The responsible institutions must be appropriately structured and staffed and there must be sufficient political buy-in to assign the necessary resources to undertake the required studies and interventions.
- In order to assess their effectiveness, interventions must be monitored and evaluated on an ongoing basis.
- The WSDPs of local authorities must list the WC/WDM initiatives that are being implemented as well as the associated targets and strategies.
- WUAs should be encouraged to develop Water Management Plans (WMPs), as required under the National WC/WDM Strategy, for the agricultural sector. The WMPs should include appointing

adequate numbers of water bailiffs for improved timing of operational releases, regular checking and maintenance of infrastructure and installation and maintenance of meters.

- A detailed study should be undertaken to assess the full potential of water re-use interventions. This should include an assessment of social acceptability and possible health risks and should be followed by the development of a detailed implementation process and plan.
- The regulatory framework for re-use needs to be strengthened.

5.3 Water Availability and System Operation

5.3.1 Background

The existing sources of the WCWSS can yield about 475 million m^3/a (at a risk of failing on average once in 50 years to supply this full requirement). The BWP, which will commence supplying water in 2007, will provide an additional 81 million m^3/a to the yield of the system, increasing the total to 556 million m^3/a. The interim ecological Reserve has been implemented in the Palmiet Catchment and has placed operational constraints on the transfer of water to the City of Cape Town's Upper Steenbras Dam. The ecological Reserve for the Berg River, immediately downstream of the Berg River Dam, has also been defined. The ecological Reserve low flows and flood releases (of up to 200 m^3/s) on the Berg River will be made from the Berg River Dam's multilevel outlet structure at the dam, according to pre-determined, agreed-upon procedures.

Managing the risk of water supply failure is an important underlying objective of system operation and maintenance. The realisation of optimum yields depends on the system being operated in such a way that the risk of overflows from the dams of the WCWSS are minimised.

Towards the end of each winter rainfall season (October to November), when the reservoirs are at their fullest, an assessment is made on whether or not supplies must be restricted for the following year, to ensure that sufficient water remains for the more essential uses, such as basic human needs and industry, were a drought to occur.

A summary of the theme objective and key issues is presented in Table 5.4. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, is detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.4 Water Availability and System Operation Theme

Objective:	To address the current annual water availability from the WCWSS as well as the requirement for optimal use of existing water resources and bulk infrastructure, Reserve-related operating rules and operational management.
Sub-theme:	**Water availability**
Key issues:	a. Quantification of water availability
Sub-theme:	**Operational management**
Key issues:	a. System operation b. Operating rules as they pertain to the Reserve c. System maintenance

5.3.2 Recommendations

The recommendations, which arose through the development of this theme, are listed below:

- The ongoing monitoring of rainfall, inclusive of patterns and spatial distribution, river flows, spring flows and abstractions are essential to provide good data for extending flow records and for identifying changes or trends that might arise from climate change.
- Monitoring the benefits of releases for the ecological Reserve on the rivers is necessary, to ensure that riverine environments are sustained and that releases in excess of the requirement for sustainability are not being made.
- Systems should be developed and staff should acquire the appropriate skills to operate the BWP and particularly to release the required floods in such a way that they coincide with and replicate natural flood events.
- The operation of the system could be further improved by monitoring individual abstractions (by installing water meters for surface water use and cumulative flow meters on boreholes and data loggers on selected boreholes) and by speeding up invasive alien plant removal.
- WUA members and staff should be trained in aquifer management, strategy and practice and to allocate budget for the interpretation and modelling of available monitoring data.
- The Water Resource Yield Model (WRYM) and Water Resource Planning Model (WRPM), together with other models, have proved to be sound tools for planning water restrictions and should be used in the future.

5.4 Comparison of requirement and availability

5.4.1 Background

Should the water requirement grow as projected for the High Water Requirement curve then the total requirement will increase to an estimated 560 million m^3/a by 2011. Figure 5.2 compares the historical water requirement and a High and a Low future water requirement scenario, with the available yields from the WCWSS. In order to ensure adequate water availability until 2030 (the selected planning horizon for this study) a number of interventions, both WC/WDM and supply interventions, will have to be implemented.

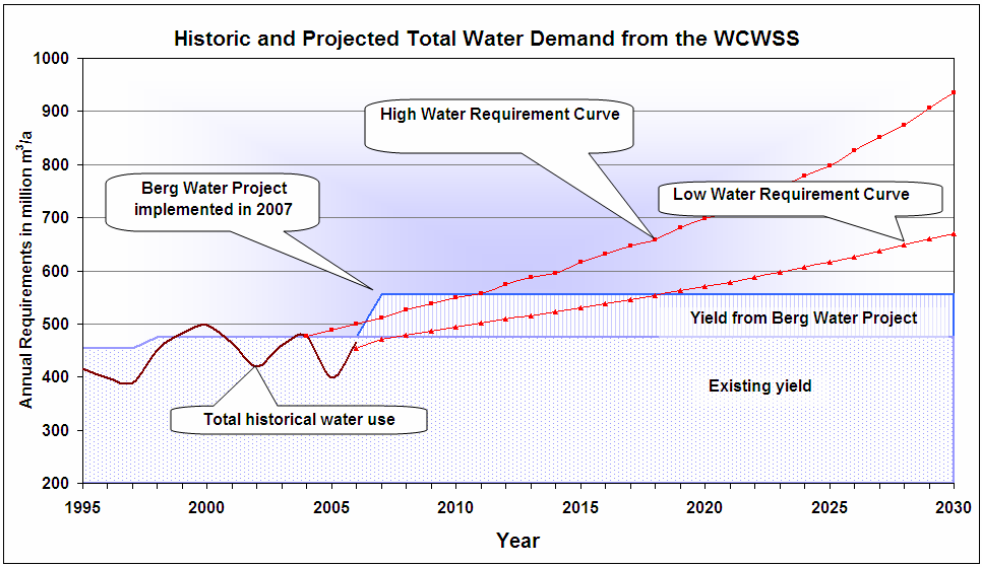

Figure 5.2 Comparison of historical water requirement and a high and a low future water requirement scenario, with the available yields from the WCWSS

When the future water requirement exceeds the available supply, all the processes for implementing the next intervention will need to have been completed. Any unforeseen delays in these processes could result in the supply exceeding availability and the need for additional water restrictions.

There is a lot of speculation regarding the potential impact of climate change on the water resources of the Western Cape Province. Box 5.1 outlines a possible manner in which climate change may impact on the WCWSS.

Box 5.1 Western Cape Climate Change Projections

Climate change projections for the Western Cape indicate:

- A drying trend from west to east, with a weakening of winter rainfall;
- Possibly increased summer rainfall (mainly in the east of the province);
- A shift to more irregular rainfall of possibly greater intensity, and
- Rising mean, minimum and maximum temperatures across the region.

In order to manage climate change the DWAF and the CCT will have to develop:

a. appropriate short term operational tactics, and
b. long-term strategies.

Themes which address climate change in the Reconciliation Strategy include:

- Water Requirements
- Water Availability and System Operation
- Comparison of requirements and availability
- Selection of interventions and decision-making process
- Monitoring and information management.

A summary of the theme objective and key issues is presented in Table 5.5 below. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.5 Comparison of Requirements and Availability Theme

Objective:	To address the reconciliation of water requirements and availability in order to identify potential future shortfalls in supply.
Sub-theme:	**Identifying the shortfall**
Key issues:	a. Determining the water balance

5.4.2 Recommendations

The recommendations, which arose through the development of this theme, are listed below:

- Data on all existing water usage should be collected on an ongoing basis and scenarios of future water use should be regularly updated.
- Information on future interventions should be available for assessment with the WRPM and the model should be utilised to reconcile supply and requirement and to determine the most appropriate timing of additional interventions.
- Information on groundwater information should be integrated into the WRYM and WRPM, which would require the implementation of suitable integrated monitoring infrastructure and data processing interpretation.

5.5 Selection of interventions and decision-making process

5.5.1 Background

One of the main objectives of the Study is to recommend a defendable, documented process for the selection of interventions to supply sufficient water to meet the requirement of the WCWSS. In addition to focusing on the process to select interventions for further study, the WCRSS also made recommendations on the approach that should be followed to select interventions for final implementation, once sufficient information has been collected through the studies. A list of interventions for further study has been proposed and is presented in the Recommendations to this Report (refer to Section 7). The public had an opportunity to comment on the proposed Study Intervention list at a final public meeting held in July 2007.

Box 5.2 Desalination

Advances in desalination technology over the last decade have significantly reduced the cost of desalination. In 2006, the cost of water from the desalination plant in Perth, Western Australia was approximately R5/m^3. The desalination plant planned for the Australian Gold Coast has an estimated cost of approx R9/m^3. A recent WRC Report (WRC Report TT 266/06 dated July 2006) calculated the unit production cost of desalination on the Cape West Coast at R7/m^3. A figure of R6/m^3 was used in this Strategy as the approximate cost of desalination.

These unit costs indicate that desalination, from a financial perspective, is still considerably more expensive than interventions such as WC/WDM, water re-use and other available ground and surface water interventions. However, financial cost comparisons are not the only important consideration and desalination may be favoured because it promotes resource diversification, and has lower environmental and socio-economic impacts, than conventional supply interventions. Desalination is an energy-intensive process and the costs and environmental impacts of additional energy would also need to be carefully considered and discounted.

A large number of interventions were identified in previous studies. The study selection process includes a review of all previously identified interventions and any additional interventions that may be considered at a common information base. The study selection process takes into account the uncertainties concerning the future water requirement as well as uncertainties in the future yield of existing water resources.

Desalination was one of the supply interventions which were considered in the Study selection process. The decreasing costs of desalination, together with the fact that desalination could provide a more environmentally acceptable solution, could result in desalination being implemented prior to some of the conventional water resource schemes which have been identified. Box 5.2 gives further information regarding desalination and the costs thereof.

Public participation is identified as a key aspect of the process and emphasis is placed on fair and transparent decision-making.

The process for selecting interventions to study or implement is discussed in more detail in Section 6.

A summary of the theme objective and key issues is presented in Table 5.6. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.6 Selection of Interventions and Decision-Making Process Theme

Objective:	The identification, evaluation and selection of interventions to reconcile supply with requirements, and the provision of information to support the decision-making process.
Sub-theme:	**Process for prioritisation of interventions**
Key issues:	a. Identifying interventions for consideration b. Studies to support the selection process c. Selection process

5.5.2 Recommendations

The recommendations which arose through the development of this theme are listed below:

- The study has emphasised the importance of transparent communication and fair decision-making and this should be continued throughout future decision-making processes.
- All key decisions should be documented and communicated to relevant stakeholders and the public.
- The proposed final selection process requires further clarification by the Strategy Committee, before it is used for final selection of a programme of interventions.
- The final selection process needs to be based on credible refinement of information and knowledge through additional studies, so that selected interventions can be compared on a common basis.
- The importance of carefully selecting and applying criteria is an important aspect for further discussion by the Strategy Committee.

5.6 Water resource protection and management

5.6.1 Background

The protection of South Africa's water resources is effected through the National Water Act (NWA) which promotes the principles of sustainability and equity. Specifically, the NWA requires that all significant water resources in South Africa be classified to determine the quantity and quality of water reserved for

ecosystem functioning (the ecological Reserve), and to ensure that they are maintained in a minimum state of health related to an acceptable level of functioning.

The Strategy will need to:

- take cognisance of the protection measures promulgated by national-level legislation;
- make provision for meaningful interaction and dialogue within processes established to facilitate implementation of the legislation, specifically CMS's, Classification and NEMA;
- ensure compliance with ecological Reserve allocations and other resource protection measures in operations and in planning initiatives.

The Strategy addresses the incorporation of water resources planning into Spatial Development Plans/Frameworks and other regional and local planning initiatives, through meaningful interaction and dialogue within local and regional processes. The Strategy also seeks to address the importance of co-ordinating the efforts of various national and regional departments and agencies so as to reduce duplication of effort, promote data sharing, ensure quality control and reporting and address gaps in data collection, relevant to the WCWSS.

A summary of the theme objective and key issues is presented in Table 5.7 below. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.7 Water Resource Protection and Management Theme

Objective:	To ensure sustainable use from current and future water sources, reservation and preservation of future water source options, as well as monitoring needs.
Sub-theme:	**Classification**
Key issues:	a. Determination of management classes and resource quality objectives for water sources b. Ecological Reserve requirements
Sub-theme:	**Sustainable utilisation**
Key issues:	a. Sustainable use of surface water b. Sustainable use of aquifers c. Impacts of water quality on system sources
Sub-theme:	**Monitoring**
Key issues:	a. Resource monitoring b. WCWSS operational monitoring

5.6.2 Recommendations

The recommendations which arose through the development of this theme are listed below:

- The importance of Classification cannot be over-emphasised. Those responsible for managing the system should be involved in the classification processes in the Western Cape. In terms of the NWA, the outcome of Classification is a set of Management Classes for significant water resources, plus their Reserve Quality Objectives (including the ecological Reserve) and

monitoring specifications and obligations, and these are binding on all authorities or institutions when exercising any power, or performing any duty under the NWA.

- To ensure sustainable use of the surface water and groundwater resources of the system, significant interaction with CMAs and other water-related authorities will be required. Interaction that is regularly needed should preferably be formalised.
- A programme should be developed to phase in the water needs to meet the ecological Reserve requirements, before waiting for compulsory licensing. Other government departments and local authorities should be persuaded to implement the necessary measures.
- Monitoring programmes must be developed, implemented and co-ordinated to ensure that the objectives of the ecological releases are met and adapted if the releases are not effective. Where ecological releases are made, measures must be in place to ensure that the objectives of the releases are met and that other users do not abstract the water.

5.7 Stakeholder engagement

5.7.1 Background

The Constitution of South Africa sets out Government's responsibility to provide the public with an opportunity to be involved in governance decisions which affect their lives. This presents an enormous challenge in communicating with a wide range of stakeholders, from the wealthy and empowered to the poor and marginalised, and across all spheres of government, from national to local.

The aim of stakeholder engagement is to enhance the quality of decision-making and operations, by facilitating mutual understanding, a common vision and supportive actions amongst and between the stakeholders.

For this study, an extensive public engagement process was followed as part of the Strategy development, to inform stakeholders of the Strategy's key issues and approaches. The process has included newspaper advertisements, public meetings, capacity building efforts, newsletters and workshops with key stakeholders. Further to this the Catchment Management Agency processes have been initiated in both the Breede-Overberg and the Berg WMAs.

Stakeholder refers to individuals, groups or organisations that have an interest, are affected by or can affect the outcome of an initiative. Stakeholder Engagement refers to the ongoing interaction with such role-players, aimed at improving decision-making during the planning, design, implementation and evaluation phases of the WCWSS.

A summary of the theme objective and key issues is presented in Table 5.8. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.8 Stakeholder Engagement Theme

Objective:	To engage with stakeholders at various tiers of government and with water institutions, raising awareness of water-related issues and building capacity of officials, politicians, stakeholders and the public.
Sub-theme:	**Co-operative governance**
Key issues:	a. Engaging with national government and parastatals b. Engaging with provincial authorities c. Engaging with regional and local authorities d. Engaging with water institutions
Sub-theme:	**Stakeholder awareness raising and capacity building**
Key issues:	a. Engaging with interested parties
Sub-theme:	**Legally required participation**
Key issues:	a. Legal processes

5.7.2 Recommendations

The recommendations which arose through the development of this theme are listed below:

- Ensure regular interactions with national, provincial and local authorities, whose laws or policies influence the use of the system.
- To enhance the efficiency of the system and to remedy user concerns or misuse, regular communication with various water-related structures such as the WUAs, CMAs, irrigation boards, water boards, the Infrastructure Agency and research institutions will be required.
- Ongoing awareness-raising and capacity building is recommended for the interested parties representing civil society, ensuring a common vision and enhanced water conservation and holistic resource management.

5.8 Monitoring and information management

5.8.1 Background

Monitoring involves measuring specific parameters to assess the current status and changes over time of those parameters and consequent decisions. Monitoring also includes the provision of information on the progress of implementing a strategy, plan or project so that responsible parties are able to make necessary adjustments to activities, inputs and budgets.

Effective monitoring includes the co-ordination and undertaking of data collection, as well as the management of data, information and knowledge.

Data is a measure or representation of observed facts in a formalised manner, suitable for communication, interpretation, or processing by human or automatic means.

Information is derived from data through data analysis and interpretation.

Knowledge is the understanding of possible consequences based on the information, context and experience, using a specific line of reasoning.

Correct and accurate data collection and management depends mainly on the experience of the allocated personnel and the capacity/suitability of the selected technology. Information and knowledge management depend very much on the relationships between people and institutions, while data management is largely process and protocol dependent.

There are three elements in a monitoring programme:

- Data collection and storage;
- Information creation through data processing, analysis, transformation, interpretation and modelling; and
- Information dissemination and knowledge improvement for a transparent decision-making process.

Chapter 14 of the National Water Act, dealing with “Monitoring, Assessment and Information”, envisages the establishment of national monitoring systems that "facilitate the continued and co-ordinated monitoring of various aspects of water resources by collecting relevant information and data, through established procedures and mechanisms, from a variety of sources including organs of state, water management institutions and water users". The National Water Resource Strategy (NWRS; DWAF, 2004) further states that the national systems "will be designed in such a way that CMAs, once established, will be able to take an appropriate level of responsibility for managing information relevant to their water management areas and, where necessary and feasible, have access to information from adjacent areas with which there are links".

The design and management of a regional monitoring and information system, for the WCWSS, should be in accordance with the systems of other regional water resource management institutions, especially those in related or contiguous catchments, and with national systems. The Strategy addresses the need to co-ordinate monitoring efforts in various aspects of the WCWSS as well as those of national and regional departments and agencies, so as to reduce duplication of effort, promote data sharing, ensure quality control, and address gaps in data collection and reporting.

A summary of the theme objective and key issues is presented in Table 5.9. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.9 Monitoring and Information Management Theme

Objective:	To ensure effective data capturing and processing and information and knowledge management to ensure sustainable water resource planning and management.
Sub-theme:	**Regional monitoring and data management**
Key issues:	a. Monitoring Framework & Programme b. Data management
Sub-theme:	**Information and knowledge management**
Key issues:	a. Information management b. Knowledge management
Sub-theme:	**Co-ordination of monitoring activities**
Key issues:	a. Develop co-operative, collaborative relationships between role-players.

5.8.2 Recommendations

The recommendations which arose through the development of this theme are listed below:

- The Strategy should address the need to co-ordinate monitoring efforts in various aspects of the WCWSS, as well as those of national and regional departments and agencies, so as to reduce duplication of effort, promote data sharing, ensure quality control, and address gaps in data

collection and reporting. This is best accomplished through the design and effective management of a WCWSS information system.

5.9 Strategy implementation and performance assessment

5.9.1 Background

Alignment of the key role-players and continuous monitoring is required to ensure performance and compliance in meeting the objective of the Strategy. In order to maintain the Strategy and keep it relevant in response to changing factors, regular revision and adequate financing is necessary. The Strategy can only be kept alive by a decision-support framework which will enable timely decisions on the implementation of water resource interventions.

A number of institutions are involved in the planning and operation of the system. These institutions should take part in the Strategy revisiting process, should be consulted and should take the responsibility to steer the Strategy in the right direction. There are currently two committees that have responsibility regarding advising and operating the WCWSS. These are:

- **The Western Cape Water System Consultative Forum**: This group of people usually meets once or twice a year to discuss the water situation of the system (by the end of winter) and to advise the DWAF's Regional Director on the need and level of curtailments for the following year. During droughts this groups meets more often.
- **The Operational Committee for the WCWSS**: This committee meets on an *ad hoc* basis regarding operational issues such as water transfers required to maximise water usages, tunnel shutdown requirements, and issues arising from metering. The committee is currently made up of representatives from the owners and operators of the WCWSS.

There exists a need to establish a Strategy Steering Committee whose responsibility it will be to ensure that the actions, responsibilities and timeframes linked to the Strategy are complied with. This Strategy Steering Committee will need to oversee the ongoing planning to ensure the reconciliation of water supply and requirement to 2030 and beyond.

A summary of the theme objective and key issues is presented in Table 5.10. The strategic actions arising from the issues and approaches, including associated responsibilities and timeframes, are detailed in the relevant Strategy Theme in the Reconciliation Strategy Report.

Table 5.10 Implementation and Performance Monitoring Theme

Objective:	To address the establishment and financial responsibilities of the committee that will implement the Strategy as well as address the performance and compliance monitoring, and oversee revision processes for the Strategy to be kept relevant and alive.
Sub-theme:	**Formalisation of the bodies to implement the Strategy**
Key issues:	a. Establishment of the Strategy Steering Committee

5.9.2 Recommendations

The recommendations which arose through the development of this theme are listed below:

- A Strategy Steering Committee should be established with the following objectives:
  - To ensure that the Strategy is relevant and updated,

- To monitor and co-ordinate the implementation of the relevant actions identified in the Strategy, and
- To make recommendations on long-term planning activities required to ensure reconciliation of requirement and available supply in the WCWSS area (i.e. recommending a feasibility study for a particular intervention to ensure timely implementation and to recommend interventions for ultimate implementation).

- The mandate and scope of work for the Strategy Steering Committee should be clearly defined, with the necessary memorandums of understanding in place from appropriate spheres of government. To ensure timely decisions, the mandate, scope of work and lines of reporting of the Committee should be drawn up and approved as soon as possible. The recommended institutions/agencies to be represented on the Strategy Steering Committee are listed in Table 5.11.
- To support the Strategy Steering Committee, an Administrative and Technical Support Group should be established to provide scientific and technical support. This support will be facilitated through DWAF: National Water Resource Planning. A scope of work for this support position should be compiled that *inter alia* covers the tasks identified in this Strategy.

Table 5.11 The recommended institutions/agencies to be represented on the Strategy Steering Committee

WC Provincial Government	**(Total 5)**
• Department of Agriculture: 1 representative • Department of Local Government and Housing: 1 representative • Cape Nature: 1 representative • Department of Environmental Affairs and Development Planning: 2 representatives i) Planning branch ii) Environmental branch	
Local Authorities	**(Total 5)**
• City of Cape CT: 3 representatives iii) Bulk water, iv) Wastewater, and v) Water demand management • West Coast District Municipality: 1 representative • Cape Winelands District Municipality: 1 representative	
Department of Water Affairs and Forestry	**(Total 9)**
• Regional Office: 3 representatives i) Institutional support, ii) Regulatory support, and iii) Water sector support • Integrated Water Resource Planning: 3 representatives i) National Water Resource Planning, ii) Options Analysis, and iii) Water Resource Planning System • Water Use Efficiency: 1 representative • Water Resource Infrastructure Branch: 2 representatives	
Catchment Management Agencies (when established)	**(Total 2)**
• Berg CMA : 1 representative • Breede-Overberg CMA: 1 representative	
Water User Associations	**(Total 2)**
• Berg WUA: 1 representative • Breede-Overberg WUA: 1 representative	
	(Total 23)

6. STUDY SELECTION PROCESS AND STAKEHOLDER ENGAGEMENT

6.1 Background

The WCRSS identifies a number of possible future interventions which should be timeously studied in order to ensure the reconciliation of water supply and requirement. It is possible that certain interventions that are selected for further study may be found to be unsuitable or may be delayed in the process of obtaining the required authorisations. It is therefore important that enough interventions are selected so as to ensure timely implementation of interventions to meet the future requirement.

The Strategy outlines two selection processes, namely:

- **A study selection process**: To identify interventions requiring additional studies (at feasibility or pre-feasibility level). The selection is based on comparing intervention scenarios. The information obtained from the studies will inform the final selection process; and
- **A final selection process**: This comprises a process to recommend the most suitable intervention for implementation. This process was not carried out during the current study but recommendations have been made on the approach to the process.

6.2 Study Selection Process

The Study Selection Process was undertaken by a multi-disciplinary team of specialists, and included significant opportunities throughout the process for public comment and review. The owners, operators and main bulk users of the WCWSS were also closely involved in the process. Specialists who were involved in the study selection process include:

- Authority representatives involved in System operation and impacted on by the operation of the WCWSS,
- Water Resources Engineer/Hydrologist (surface water),
- Geo-hydrologist (Groundwater),
- Environmental Scientist (Aquatic Scientist), and
- Social Scientist/ Resource Economist (with water expertise).

The proposed process for selecting interventions is described below and is illustrated in Figure 6.1. To date, Steps 1 to 5 have been completed during the Study. On the 19th July 2007, the final Strategy and the list of proposed interventions for further study were presented to the public for comment. The comments received will be integrated into future versions of the Strategy, by the proposed Strategy Steering Committee.

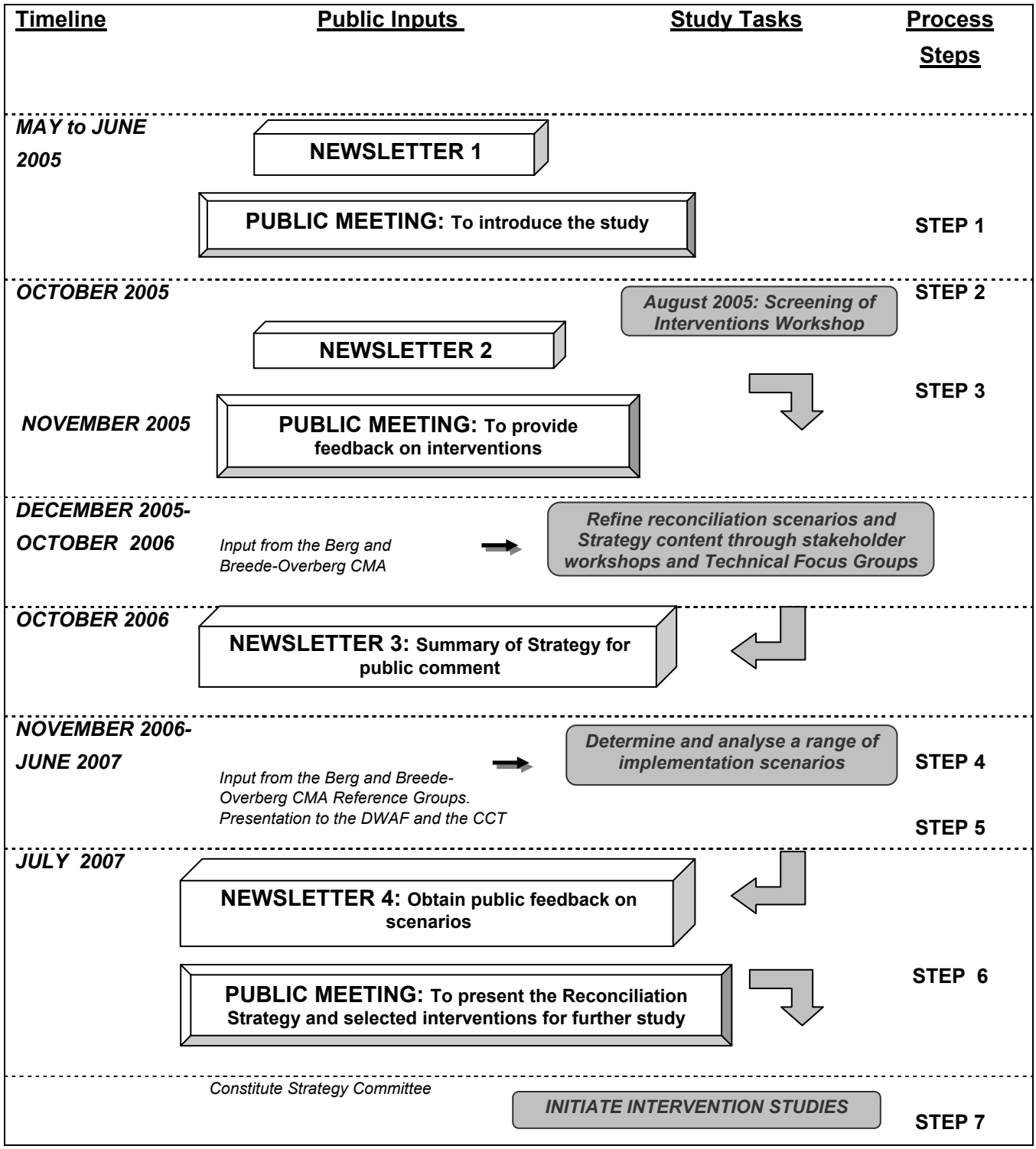

Figure 6.1 Overview of the Study Selection Process undertaken during the WCRSS

Step 1: Identify interventions

a. List and document all possible interventions to a common base of information.

b. Obtain public input on additional interventions and amend proposed list.

c. Consider the time required to implement each intervention and recommend a likely implementation programme for each intervention.

Step 2: Screen interventions

a. Identify a representative multi-stakeholder group to assist in the screening process.
b. Use agreed criteria to screen interventions that have fatal flaws (the criteria used in the Selection of Intervention Workshop have been included in the Reconciliation Strategy: Appendix C).
c. Maintain a record of screened interventions which could be considered if additional information or technology becomes available.
d. Update the implementation programmes, taking into account further input.

Step 3: Public Review of Selected Interventions

a. Obtain public feedback on the screening process.
b. Update the programme and list of interventions.

Step 4: Scenario Planning Process

a. Identify a range of possible implementation scenarios using the RPST.
b. Analyse the scenarios and document the outcomes.

Step 5: Review of selected intervention scenarios by water institutions, authorities and local political representatives.

a. Obtain feedback on the scenarios from a multi-stakeholder group, including water institutions and local authorities.
b. Revise implementation scenarios, programmes and actions to be taken.

Step 6: Obtain public feedback on scenarios

a. Obtain public feedback on the proposed scenario(s) for further study.
b. Update the scenarios accordingly.

Step 7: Initiate studies

a. Strategy Steering Committee recommends studies to the DWAF and CCT and communicates decisions to the public.

6.3 Scenario Planning Process

The objective of the Scenario Planning Process (Step 4) is to identify, evaluate and assess alternative groupings and phasing of interventions in order to determine the most appropriate combination of interventions that should be implemented, to reconcile water supply and requirement in the WCWSS. The combination of interventions selected to meet the requirement, is termed a scenario. Due to the lead times required for feasibility studies, interventions need to be identified well in advance, so that they are ready for implementation within the required time frame. While conducting the feasibility studies, some interventions may be found not to be suitable for implementation. For that reason, the scenario planning process considers a range of possible scenarios to reconcile water supply and requirement. The objective is not to select one "favourable scenario" but to identify which interventions should be studied to allow consideration of a range of possible scenarios. This will allow the DWAF and the CCT, and other stakeholders, the maximum amount of flexibility in making informed decisions on which interventions to implement after the BWP, and beyond. The outcome of the process will be a list of interventions that should be studied, by specific dates, so as to facilitate the implementation of a range of reconciliation scenarios.

6.3.1 The Reconciliation Planning Support Tool

The RPST was developed to facilitate the selection process by comparing potential interventions with one another for a selected future water requirement scenario. Information contained in the RPST inter alia includes: various water requirement scenarios, the current system yield, intervention programmes, intervention yields, financial parameters and the CCT's WC/WDM Strategy implementation programme.

The Planning Tool is run in Excel, with Visual Basic macro-programmes. This tool is interactive, and the user can adjust all input data. The tool graphically shows when decisions regarding investigations for selected interventions need to be taken to achieve a water balance. It can also show the time-related implementation programmes for the selected interventions, the effects of water conservation and demand management in reducing requirements and the increases in system yield provided by supply side interventions. An output table indicates the required study start dates for the various interventions of a selected suite, comprising a scenario. Due to the lead times required for feasibility studies, interventions need to be identified well in advance so that they are ready for implementation within the required time frame.

Figure 6.2 graphically depicts implementation lead times of the interventions contained in the RPST. Figure 6.3 indicates the location of the interventions within the WCWSS.

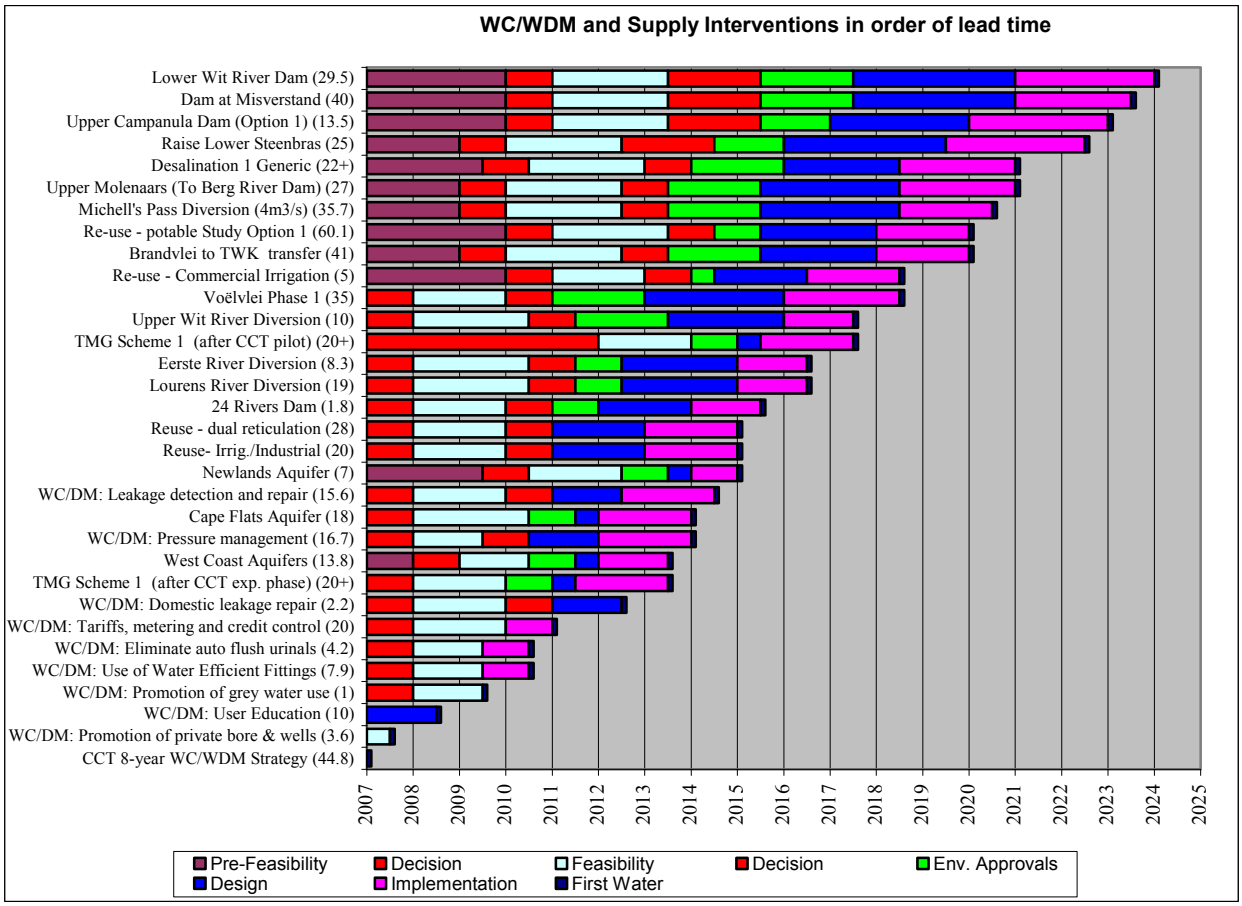

Figure 6.2 Lead times of Interventions contained in the RPST

A basic Multi Criteria Decision Making function was included in the RPST, to assist the user in the selection process. This enables the user to alter the weightings of the criteria and to alter the criteria

themselves. Five different variables can be compared on this basis. The remainder of the criteria can be utilised for a more qualitative assessment. A set of filters is included for all the criteria, so that interventions can be analysed in various ways. The tool also displays financial parameters, namely unit reference values, operating costs, capital costs and the unit cost of water per intervention selected. The tool can also give the net present values and expected cash flows for a selected suite of interventions. Figure 6.4 contains a graphic illustration of water balance sheet output for one of the Scenarios which were investigated.

6.3.2 Scenarios analysed

During the Study, twelve possible scenarios for reconciling the water requirements with the available resources were tested against the determined water requirement curve(s). The time required to implement the interventions, as well as the costs and associated risks were carefully considered.

A range of scenarios was utilised to inter alia assess the following:

- The benefits of implementing WC/WDM;
- The reconciliation and supply implications of implementing the ecological Reserve for existing water resources; and
- The reconciliation and supply implication arising from climate change.

Table 6.1 contains a list of the intervention scenarios which were analysed as part of the Scenario Planning Process, as well as the objectives associated with each scenario.

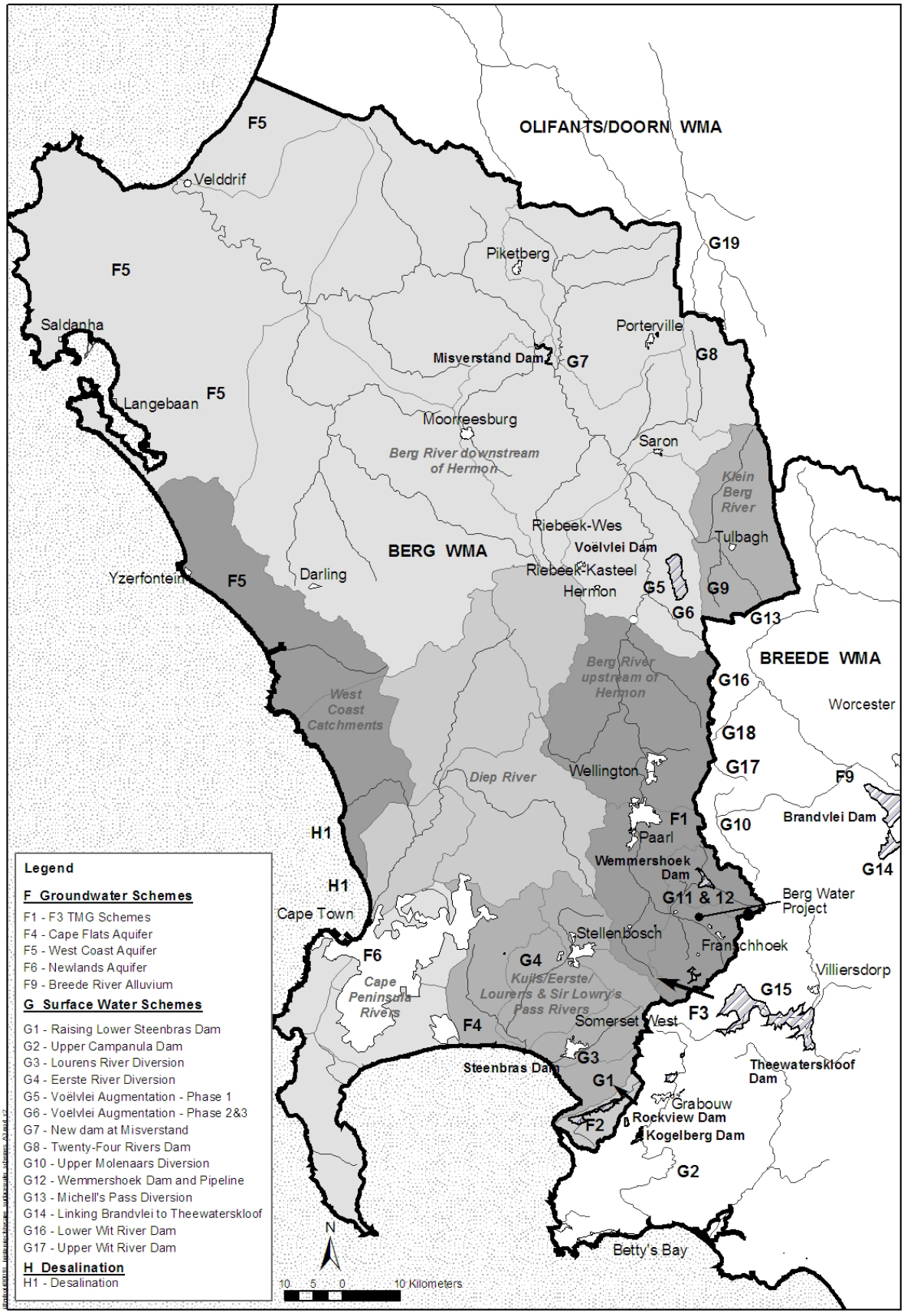

Figure 6.3 Location of Interventions within the WCWSS

Table 6.1 Intervention scenarios analysed in the scenario planning process

Scenario	Description
Scenario 1 (illustrative)	No WC/WDM. All supply-side interventions can be implemented
	Objective: To determine the impact of not implementing WC/WDM
Scenario 2 (illustrative)	CCT WC/WDM strategy and programme implemented: all supply-side interventions can be implemented
	Objective: To determine the impact of implementing the CCT's WC/WDM strategy and 8-year programme
Scenario 3 (illustrative)	CCT WC/WDM strategy and programme implemented, as well as additional WC/WDM interventions. All supply-side interventions can be implemented
	Objective: To determine the impact of implementing all WC/WDM interventions
Scenario 4 (illustrative)	CCT WC/WDM strategy and programme implemented: only groundwater interventions can be implemented
	Objective: To determine how groundwater interventions could meet the future requirement
Scenario 5 (a and b) (illustrative)	CCT WC/WDM strategy and programme implemented: Only treated effluent use interventions can be implemented
	Objective: To determine how treated effluent use interventions could meet the future requirement
Scenario 6 (illustrative)	CCT WC/WDM strategy and programme implemented: Only desalination implemented
	Objective: To determine how desalination interventions could meet the future requirement
Scenario 7 (reconciliation)	CCT WC/WDM strategy and programme implemented: Thereafter selection of interventions based on URV (both WC/WDM and supply-side interventions)
	Objective: To determine the impact of selecting interventions based on lowest URV
Scenario 8 (reconciliation)	CCT WC/WDM strategy and programme implemented: Thereafter selection based on URV (Scenario 7) with the ecological Reserve being phased in for existing water resources
	Objective: To determine how the implementation of the ecological Reserve will impact on the selection of interventions
Scenario 9 (reconciliation)	CCT WC/WDM strategy and programme implemented: Thereafter selection based on URV (Scenario 7) with the potential for climate change being considered
	Objective: To determine how climate change could impact on the selection of interventions
Scenario 10 (a) (reconciliation)	CCT WC/WDM strategy and programme implemented: Thereafter selection based on a “conservative portfolio” of interventions
	Objective: To determine the impact of selecting a “conservative portfolio”
Scenario 10 (b) (reconciliation)	CCT WC/WDM strategy and programme implemented: Thereafter selection based on a conservative portfolio of interventions, including potential impacts of the ecological Reserve and climate change
	Objective: To determine how the implementation of the ecological Reserve and the potential for climate change could impact on the selection of interventions
Scenario 10 (c) (reconciliation)	All WC/WDM interventions implemented (as per Scenario 7): Thereafter selection based on a conservative portfolio of interventions, including potential impacts of the ecological Reserve and climate change
	Objective: To determine how the implementation of additional longer-term WC/WDM interventions impacts on Scenario 10(b)
Scenario 11 (reconciliation)	The Low Water Requirement Curve formed the basis of this analysis: CCT WC/WDM strategy and programme implemented: Thereafter selection based on URV (Scenario 7)
	Objective: To determine how the LWR Curve and the least URV selection criteria could impact on the selection of interventions

6.3.3 Examples of Scenarios Analysed

This section of the report serves to provide an illustrative example of some of the scenarios which were anlaysed. For a comprehensive analysis of all the scenarios, please refer to the report entitled Scenario Planning for the Reconciliation of Water Supply and Requirement.

Scenarios 1 to 3 showed the importance of implementing WC/WDM. Scenario 3, illustrated in Figure 6.4, shows how the implementation of WC/WDM has the potential to delay the implementation of a supply side intervention until 2019.

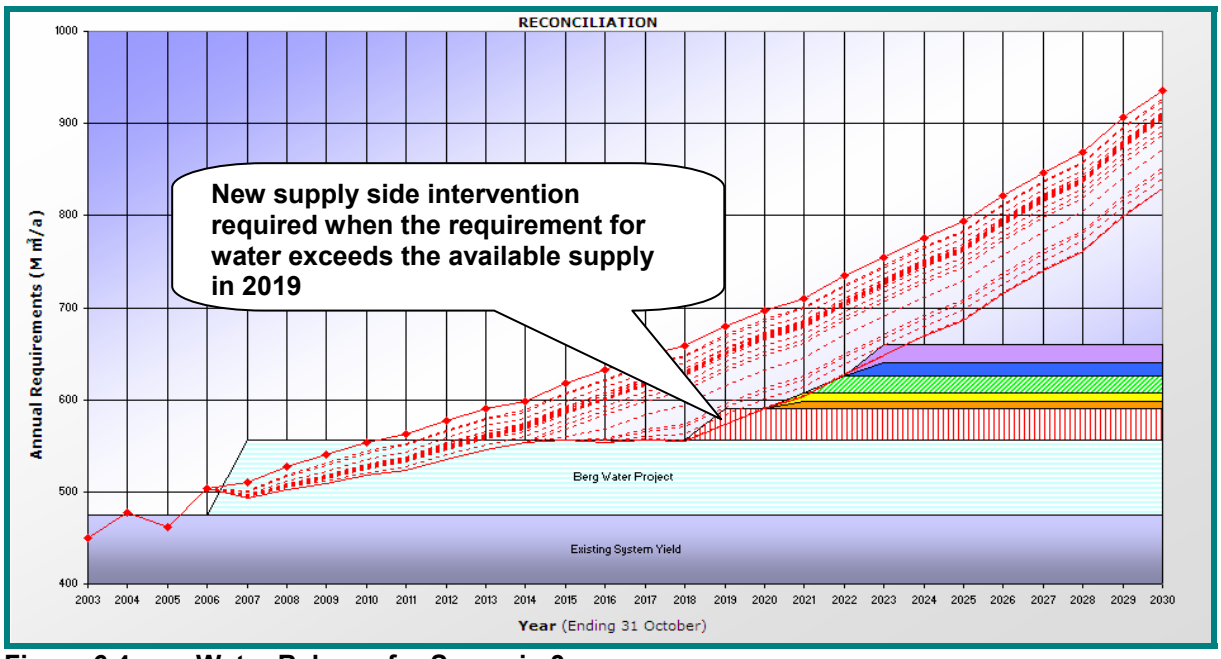

Figure 6.4 Water Balance for Scenario 3

Scenarios 6 through to 10 select a possible combination of WC/WDM and supply interventions, to ensure the reconciliation of supply and requirement. Scenarios 7, 8 and 9 were based on implementing interventions with the lowest cost per unit volume of water supplied. Scenario 10 was based on a "conservative portfolio" identified by the DWAF and the consulting team, based on their knowledge of the WCWSS, the supply schemes available for selection and on the practicality of implementing some of the interventions. Scenario 10(c) illustrates a very different picture to that of Scenario 3 portrayed above. In this scenario, it is assumed that DWAF has implemented the ecological Reserve for the existing System resources and also assumes that climate change could impact on the availability of water in the future. In Figure 6.5, one can clearly see how the available supply decreases whilst the requirement for water steadily increases. Should this "worst case" scenario arise, DWAF and the CCT would have to implement a number of supply-side interventions and also the reclamation of treated effluent to potable standards or desalination as a future option. Figure 6.5 graphically depicts the impact of implementing the ecological Reserve and the potential impact of climate change on the reconciliation of supply and requirement.

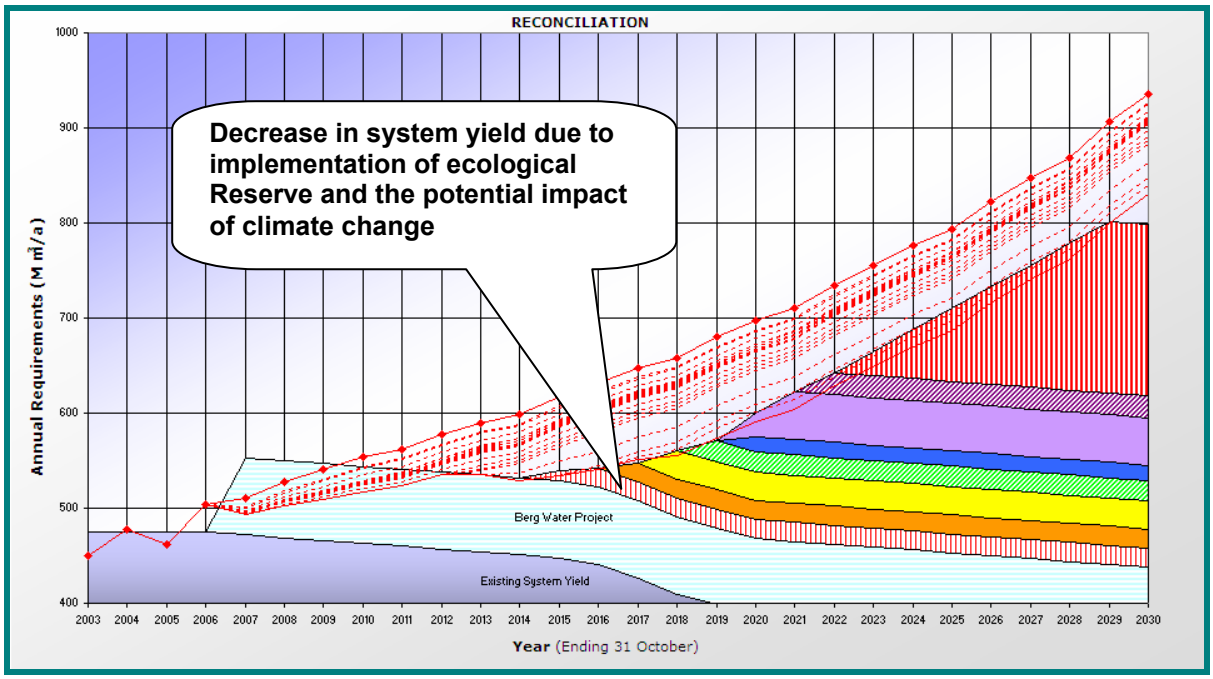

Figure 6.5 Water Balance for Scenario 10 (c)

Scenario 11 illustrates when a new supply-side intervention would be required, should the actual water requirement follow the Low Water Requirement curve, which reflects a low population and economic growth. In this scenario, depicted in Figure 6.6, a new supply intervention would only be required by 2025.

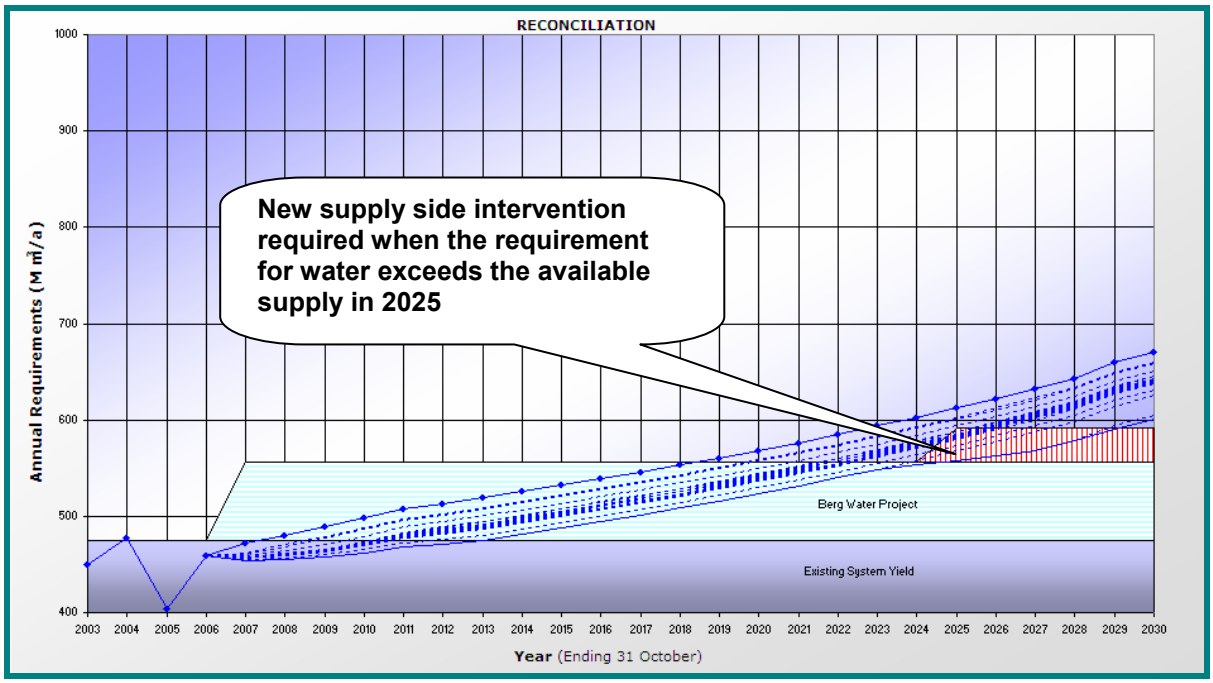

Figure 6.6 Water Balance for Scenario 11

6.4 Conclusions from the Scenario Planning Process

The following conclusions can be drawn from the Scenario Planning Process :

- Successful implementation of the CCT's 8-year WC/WDM strategy and programme (assuming that the High Water Requirement curve is followed) will delay the implementation of a new water resource until 2015.

- It is imperative that the CCT implement its 8-year WC/WDM Strategy as well as investigate additional longer-term WC/WDM interventions, as the long lead times required to implement a supply-side intervention precludes the selection of a supply side intervention, prior to 2013, under the High Water Requirement curve. Should the CCT be successful in implementing its WC/WDM strategy and programme and all additional longer term WC/WDM interventions, a new supply-side intervention will only be required by approximately 2019. Should the actual water requirements follow the Low Water Requirement curve, a new water source will only be required by 2025.

- If the CCT is unsuccessful in implementing its WC/WDM strategy and programme, and assuming that the High Water Requirement curve is followed, then the requirement will exceed the supply in 2011 and the CCT will face an increased possibility of having to impose water restrictions on its consumers. Under these circumstances, the TMG Aquifer Scheme and/or other supply-side interventions will have to be "fast tracked" or the implementation lead time of certain interventions will have to be reduced.

- A number of WC/WDM interventions and supply-side interventions should be considered for further studies for the following reasons:

    - Additional WC/WDM interventions were based on the Integrated Water Resource Planning Study, which was completed in 2001. This information needs to be reviewed and new yields and costs should be developed.
    - The current supply-side intervention studies have differing levels of estimated information regarding yields, costs and ecological impacts. It is important to compare interventions on the same level of information.
    - It is important to conduct a number of studies at pre-feasibility level and feasibility level (including EIAs) as these feasibility studies may show that one or more of the preferred interventions are no longer available for implementation.
    - It is important to study a mix of supply-side interventions (namely surface water, groundwater, treated effluent use and desalination) as the potential impact of the changing weather patterns (climate change) is unknown and the authorities may decide to implement certain initiatives which are not dependent on rainfall.
    - The impact of implementing the ecological Reserve on the yields of the existing water resources has not been studied in detail. However, the implementation of the ecological Reserve will require that more supply-side interventions be implemented, in order to offset the deficit in yield, which would be incurred when the ecological Reserve is implemented.

Should the actual water demand be lower than projected, the responsible authorities may decide to implement an intervention that has a lower URV and a longer implementation lead time, in preference to an intervention that has a higher URV and a shorter intervention lead time.

From the analysis of Scenarios 7 to 11, a table of the study start dates was developed. Table 6.2 gives a summary of the required intervention study start dates. The study start dates shown in bold (and shaded in blue) indicates where it was necessary to "fast track" the implementation of certain interventions in order to ensure the reconciliation of supply and requirement for that particular scenario.

Table 6.2 Summary of Intervention Study start dates

Intervention	Required Study Start Date for Scenarios							Earliest Date
	7	8	9	10(a)	10(b)	10(c)	11	
CCT WC/WDM strategy and programme	2007	2007	2007	2007	2007	2007	2007	2007
WC/DM: Adjustment of water tariffs, metering and credit control	2011	2011	2009			2009	2020	2007
WC/DM: Eliminate auto-flush urinals	2011	2011	2009			2009	2025	2007
WC/DM: Promotion of private boreholes and wells	2015	2015	2012			2012		2007
WC/DM: Leakage detection and repair	2007	2007	2007			2007		2007
WC/DM: Use of Water Efficient Fittings	2018	2016	2016			2012		2007
WC/DM: User Education	2025	2023	2022			2014		2007
Voëlvlei Phase 1	2007	2007	2007	***2007***	***2007***	2007	2011	2007
Michell's Pass Diversion	2007	2007	2007	***2007***	***2007***	2007	2011	2007
Newlands Aquifer	2008	2008	2007					2007
Cape Flats Aquifer	2015	2010	2009					2009
West Coast Aquifers	2016	2013	2013					2013
24 Rivers Dam	2014	2012	2012					2012
"Fast-tracked" TMG Scheme 1 (20 million m^3)				2008	2007			2007
"Fast-tracked" TMG Scheme 2 (50 million m^3)				2013	2009			2009
"Fast-tracked" TMG Scheme 3 (70 million m^3)								
TMG Scheme 1 (20 million m^3)	2018	2016	2015			2007		2015
TMG Scheme 2 (50 million m^3)	2014	2012	2011			2007		2011
TMG Scheme 3 (70 million m^3) see Notes	2010	2007	2007					2007
Upper Wit River diversion	2007	2007	2009					2007
Raising Steenbras Lower Dam		2012	2011	***2009***	***2007***	***2008***		2007
Lourens River Diversion		2019	2018	2011	2007	2010		2007
Upper Molenaars Diversion					2007	2008		2007
Re-use irrigation/industrial	2013	2010	2009	2010	2007	2007		2007
Dual Reticulation								
Commercial Irrigation Exchange								
Treated Effluent to Potable Standards					2007	2010		2007
Removal of Invasive Alien Plants	***O n g o l n g***							
Desalination					2011			2011

Date Indicates a "fast-tracked" or reduced implementation time

Date Indicates studies required in 2007

Notes :

1) Voëlvlei Phase 1 and Michell's Pass utilize the same infrastructure
2) If an intervention with reduced lead time gave a study start date after 2007, it was made 2007
3) If study start date was 2006.5 or 2005 it was made 2007, otherwise study start dates were rounded down
4) Where TMG Scheme (not fast-tracked) gives 2007 study start date, this implies that the CCT Feasibility Study and Pilot Project should continue in 2007.

6.5 Final Selection Process

Once all the selected interventions have been studied to the same level of information, the DWAF and the CCT, in dialogue with other stakeholders, will take a decision on which interventions should be implemented. This process to select interventions for implementation, called the Final Selection Process, will be determined by the future Strategy Steering Committee and will include the following key components:

- Stakeholder input will be included in various parts of the process, including the criteria against which the interventions will be evaluated and compared. (Reconciliation Strategy: Appendix C provides an example of the criteria that could be used).
- Public participation will constitute a key part of the legal EIA processes required to implement the interventions.
- The RPST will be used to assist in the decision-making process. To make sure that decisions are based on the best available data, information obtained through the feasibility studies should be continuously incorporated into the RPST.
- The outcome of important technical decisions will be communicated to the public through public meetings.
- The Strategy Steering Committee will make recommendations to the Minister of the DWAF on the next supply-side intervention to be implemented.
- Information obtained from the studies will be communicated to the public as appropriate.
- The final decision on the next intervention will be made by the Minister of Water Affairs and Forestry.

7. SUPPORTING REPORTS

Individual stand-alone reports were prepared to support and inform the WCRSS. These reports focussed on the CCT's progress with respect to the implementation of WC/WDM and also considered the potential for treated effluent use within the CCT. The recommendations emanating from these reports have been integrated into the Strategy and into the recommendations of the Summary Report.

A brief overview of these reports is provided below:

7.1 Overview of Water Conservation and Demand Management in the City of Cape Town

WC/WDM will form an important component of any future suite of reconciliation interventions for the WCWSS. This report therefore investigates the extent to which WSAs in the study area are currently undertaking investigations and/or are implementing WC/WDM interventions, in order to assess the potential impact that WC/WDM may have on the future water requirements in the study area. Where the WSAs have implemented WC/WDM interventions, the cost, benefits and challenges of implementing these interventions are assessed. Furthermore, this report assesses the effectiveness of the drought mitigation measures that were imposed to reduce water use during the recent droughts and the ability of the WSAs to reduce water use during future droughts, given the experiences of the droughts and in light of anticipated enhanced water use efficiency in the future.

Most of the WC/WDM projects/interventions undertaken by the CCT were started during or shortly after the completion of the IWRP Study in 2000 and were focused on the areas newly incorporated into the CCT, following the local government elections of 2000. These projects were largely aimed at improving service delivery to these areas which historically had not been well managed and maintained. Some of these projects such as the iKapa Leaks Project (saved 1.8% of CCT's total demand) and the Khayelitsha Pressure Management Project (saved between 2% and 3% of CCT's total demand) proved to be very successful.

Since the completion of the IWRP Study and, apart from implementing WC/WDM projects, the CCT has had to impose restrictions and implement other demand reduction initiatives (i.e. increased tariffs and more intense public awareness campaigns) to mitigate the impacts of the droughts of 2000/01 and 2004/05. Although drought mitigation interventions (demand reduction focus) are similar in certain respects to WC/WDM interventions (demand optimisation focus), and would probably form part of any long-term WC/WDM strategy, there are fundamental differences between them.

In conjunction with the drought mitigation measures and WC/WDM projects implemented, the CCT has initiated comprehensive community awareness and education campaigns, aimed at promoting water use efficiency. These collective initiatives have resulted in a significant increase in public awareness, concerning the scarcity of water in the area, and the need to use water more efficiently. This is confirmed through preliminary investigations, which indicate that winter demands have remained almost constant since 2000, whilst the summer demands indicate a decline.

Consumer surveys conducted to date indicate that some 57% of residential consumers have changed their water use behaviour, the primary reasons being:

- Price (41%);
- Restrictions (32%); and
- Awareness campaigns (20%).

More recently, a comprehensive WC/WDM Strategy and programme was approved by the CCT's Utility Services Portfolio Committee, the Mayoral Committee and the full Council, in May 2007.

For more detail regarding programmes and initiatives implemented by the CCT, refer to the Strategy Report entitled Overview of Water Conservation and Demand Management in the City of Cape Town.

7.2 Treatment of Effluent to Potable Standards for Supply from the Faure Water Treatment Plant

The advancement of membrane technologies (micro-filtration and reverse osmosis) in recent years has provided opportunity to consider the application of these technologies for the reclamation of treated effluent to potable water standards. In particular, the application of these technologies for the treatment of effluent for potable supply at the Faure Water Treatment Plant, proposed during the earlier investigations, would eliminate the need to blend "reclaimed" water with "conventional" potable water, thereby increasing the yield possible from the scheme.

The objectives of this conceptual level investigation were to:

- Assess the suitability of using membrane technology for the reclamation of treated effluent for potable use in general, and in particular, the implications of its use in the augmentation scheme proposed during earlier investigations; and
- Review the operating and infrastructure constraints inhibiting the optimal use of treated effluent via the scheme previously proposed, as well as the particular implications of transferring reclaimed water from the Faure Water Treatment Plant to the Blackheath Water Treatment Plant/reservoirs.

The processes for the treatment of sea water and treated effluent via ultra filtration and reverse osmosis to potable standards are similar. However, the capital, operating and maintenance costs of the reclamation plants are directly related to the TDS content of the influent, and therefore these costs are significantly lower for the reclamation of treated effluent as opposed to sea water. The indirect re-use of reclaimed treated effluent for potable use (i.e. used as a raw water source), is used fairly extensively elsewhere in the world. In most instances, the treated effluent is reclaimed by membrane technology systems before being introduced into conventional raw water resources. The direct re-use of reclaimed treated effluent for potable use, irrespective of the reclamation process involved, is not practiced extensively at present, and appears to be limited to a few African countries only. In most instances, the reclaimed water is blended with "conventional" potable water supplies before being made available for consumption.

A pilot study conducted in Singapore indicates that the use of membrane technology in the reclamation of treated effluent for potable use, can provide a reliable and robust system that can cost-effectively produce potable water that is safe for human consumption, either via indirect or direct input to the water distribution system. By adopting variations in the configuration of the scheme proposed during the earlier studies, the application of membrane technology can deliver a viable and cost effective augmentation scheme that includes brine handling.

7.3 Overview of Water use potential from Wastewater Treatment

Treated effluent use is likely to form part of any future suite of reconciliation interventions for the WCWSS. This report investigated the current state of treated effluent use and possible future

interventions. The objective of the investigation was to determine the extent to which WSAs in the study area are currently using treated effluent, undertaking investigations to assess the potential for using treated effluent and planning and/or implementing such projects. The report also addresses the impact of the recent droughts in terms of treated effluent use in general and specifically, the demand for treated effluent.

Treated effluent is mainly used within the CCT and by a few industries in the West Coast District Municipality for process purposes. However, the use of treated effluent has only been pursued to a limited extent and not on an integrated and sustained basis by any of the WSAs in the WCWSS area. Furthermore, the use of treated effluent has by and large occurred on an *ad-hoc* basis, often driven through private sector initiatives.

Approximately 9.4% of the average dry-weather flow (ADWF) in the CCT is currently being re-used, primarily for local irrigation of public open spaces and sports fields and for industrial use. This equates to some 11.6 million m³/a.

The investigations undertaken to date for the CCT identified the following potential for the use of treated effluent :

"Non-potable" use options:	50.2 million m³/a	(29% of the current ADWF)
"Potable" use options:	74.6 million m³/a	(43% of the current ADWF)
Total	124.9 million m³/a	(72% of the current ADWF)

Based on studies undertaken to date, it is evident that many of options investigated to use treated effluent are economically feasible, especially those for local irrigation and industrial use.

Treated effluent is a valuable water resource, which should be considered in all future water-resource planning studies. As was borne out during the recent droughts, given certain conditions, e.g. restricted water supplies and/or appropriately priced treated effluent of suitable quality and assurance, there is a demand for treated effluent, especially for local irrigation, agricultural and industrial use. Furthermore, the use of treated effluent options investigated to date, particularly some of the non-potable use options, are cost competitive.

Most municipalities in the WCWSS area have to date not sought to maximise the use of this resource in an integrated and sustained manner and limited or no investigations of the use of treated effluent have been conducted outside of the CCT. This could in part be attributed to ongoing concerns regarding the use of treated effluent such as salt build-up in soils, long-term health impacts and the ability of the respective water services institutions to effectively operate and maintain treatment of effluent schemes. Furthermore, there appears to be limited national policy and guidelines in place at present to specifically regulate/direct the use of treated effluent.

8. RECOMMENDATIONS

Based on the findings of the study, the following recommendations are put forward to ensure ongoing reconciliation of supply and requirement within the WCWSS.

General Recommendations

a. A Strategy Steering Committee, supported by an Administrative and Technical Support Group, should be formed in order to make recommendations, on an annual basis, on long-term planning activities required to ensure reconciliation of water requirement and available supply in the WCWSS area.

b. Actual population and economic growth rates, as well as actual water use by user category, need to be monitored and updated in the water requirement model, so that future water requirement projections can be accurately monitored and predicted.

c. Commitment to and endorsement of WC/WDM by all role-players in the water sector should be obtained and/or enhanced to ensure an environment conducive to the implementation of WC/WDM measures on a sustainable basis.

d. Water use efficiency must become central to all WSAs' planning and WSPs' operations and the capacity of the respective institutions should be enhanced to ensure effective implementation of WC/WDM. Activities undertaken by WSAs should include:

- Reviewing tariffs to reflect scarcity of water supplies,
- Maintaining high profile community information and education campaigns,
- Promoting water use efficiency,
- Ensuring that water-efficiency measures/devices are implemented/installed for all new consumers and
- Ensuring appropriate monitoring/tracking and reporting of all aspects of WC/WDM.

e. In terms of water re-use, it is recommended that the following aspects be investigated:

- Water treatment works which produce higher quality effluent and are therefore better suited to service potable use schemes,
- The location of industrial centres that could be serviced by treated effluent schemes,
- Opportunities for using treated effluent to meet riverine Reserve requirements, and
- Opportunities for extending "local irrigation" with treated effluent schemes and to provide supplies for domestic gardening and/or toilet flushing.

f. WUAs should be encouraged to develop WMPs, as required under the National WC/WDM Strategy, for the agricultural sector.

g. The operation of the System could be further improved by monitoring individual abstractions (by installing water meters for surface water use, cumulative flow meters on boreholes and data loggers on selected boreholes), and by speeding up invasive alien plant removal.

h. A study should be undertaken by the DWAF to investigate and assess the implications and costs of implementing the ecological Reserve on existing water resource schemes.

i. A WCWSS information system should be developed that will assist in promoting a co-ordinated monitoring effort on various aspects of the WCWSS; this could include data sharing, quality control, and addressing gaps in data collection and reporting.

j. The Scenario Planning process should be updated on a regular basis to cater for:

- Revised future water requirement projections.
- Updated information on the implementation of the ecological Reserve and the potential for climate change.
- Updated and refined information from recently completed studies (reconnaissance level, pre-feasibility level and feasibility level) for WC/WDM and supply-side interventions.
- Any other change to the input data.
- Revision to the CCT's 8-year WC/WDM strategy.

k. Ongoing awareness-raising, capacity building and information sharing is required for the interested parties representing civil society, ensuring a common vision and enhanced water conservation and holistic resource management.

l. The final selection process, to select which interventions will be implemented after the BWP, needs to be based on credible refinement of information and knowledge through additional studies, so that selected interventions can be compared on a common basis.

Specific recommendations related to the selection of interventions

m. The CCT's 8-year WC/WDM strategy and programme should be implemented, to ensure that there is no shortfall prior to the implementation of the next intervention.

n. The CCT should initiate a feasibility study to determine the potential of additional longer-term WC/WDM interventions to be implemented, beyond the existing 8-year strategy. Table 8.1 contains a summary of the start dates for the WC/WDM intervention studies.

o. Studies at an appropriate level of detail should be carried out for all the supply-side interventions listed in Table 8.2.

Table 8.1 Recommended Start Dates for Water Conservation and Demand Management Intervention Studies

Intervention	Date Study to be Started	Study Level Required	Responsibility
CCT 8-year WC/WDM Strategy and Programme	2007	To be implemented	CCT
Longer-term WC/WDM Interventions			
WC/DM: Adjustment of water tariffs, metering and credit control	2007	Feasibility (yields to be updated)	CCT
WC/DM: Eliminate auto-flush urinals	2007	Feasibility (yields to be updated)	CCT
WC/DM: Leakage detection and repair	2007	Feasibility (yields to be updated)	CCT
WC/DM: Promotion of private boreholes and wells	2007	Feasibility (yields to be updated)	CCT
WC/DM: Use of water efficient fittings	2007	Feasibility (yields to be updated)	CCT
WC/DM: User education	2007	Feasibility (yields to be updated)	CCT

Table 8.2 Summary of Supply-side Intervention Study Start Dates

Intervention	Date Study to be Started	Study Level Required	Responsibility
Existing Feasibility Studies/Projects			
TMG Aquifer Feasibility Study	Ongoing	Feasibility	CCT
Pilot Desalination Plant	Ongoing	Feasibility	CCT
TMG Regional Monitoring	Ongoing	Monitoring	DWAF
Invasive alien plant clearance	Ongoing	Ongoing	DWAF
Planned Future Studies			
Voëlvlei Phase 1 (Note 1)	2007	Update feasibility	DWAF
Michell's Pass Diversion	2007	Pre-feasibility/Feasibility (Note 2)	DWAF
Newlands Aquifer	2007	Pre-feasibility	CCT
Cape Flats Aquifer	2007	Feasibility	CCT
West Coast Aquifer Recharge (Langebaan Road Aquifer)	2007	Pre feasibility	DWAF
Upper Wit River Diversion	2007	Pre-feasibility	DWAF
Raising Steenbras Lower Dam (including pre-feasibility of Upper Campanula Dam)	2007	Pre-feasibility	DWAF/CCT
Lourens River Diversion Scheme	2007	Update Pre-feasibility (as linked to Raising Steenbras Lower)	CCT/DWAF
Upper Molenaars Diversion	2007	Pre-feasibility	DWAF
Effluent Re-use (policy, effluent treated to potable standards, effluent treated use for irrigation/industry)	2007	Pre-feasibility	CCT and all WSAs
WCWSS Use of Treated Effluent Study	2007	Pre-feasibility	DWAF

Notes :
1. This would include a pre-feasibility study of the Voëlvlei Phase 2 Scheme.
2. Michell's Pass Diversion may have to be carried out at feasibility level to enable comparison with Voëlvlei Phase 1.

p. More information is required on certain interventions (specifically in terms of yield and cost) to assess their viability. Interventions where very little data exists should be studied at reconnaissance level, so that a comparative evaluation can be made in the future. These interventions are listed in Table 8.3.

Table 8.3 Summary of Intervention where Insufficient Information is Available

Intervention	Timing	Responsibility
Groundwater		
Conjunctive use	To be determined by Strategy Steering Committee	DWAF
Artificial Recharge (ASR)	To be determined by Strategy Steering Committee	DWAF
Artificial Recharge: Breede River Alluvium	To be determined by Strategy Steering Committee	DWAF
Maximise existing infrastructure		
Steenbras Pumped Storage Scheme Intake improvement	2007	CCT
Possible additional off-channel raw water storage at Misverstand Dam	To be determined by Strategy Steering Committee	DWAF
Maximise WCWSS yield		
Improve operation of Kleinplaas Dam	2007	CCT
Improve operation of Atlantis Aquifer (see Note 1)	2007	CCT
Other		
Implications of implementing ecological Reserve on existing water resources	To be determined by Strategy Steering Committee	DWAF
Water Trading	As soon as possible	All WSAs
Non-flow Related Interventions	To be determined by Strategy Steering Committee	DWAF
Integrated Catchment Management	To be determined by Strategy Steering Committee	DWAF
Integrated WSWSS Treated Effluent Use Study (including Berg River water exchange)	2007	DWAF
Note 1: Improved management and operation of the Atlantis Aquifer will reduce the reliance placed on Voëlvlei Dam		

q. The CCT should proceed with the TMG Aquifer Feasibility Study and Pilot Project, as the TMG Aquifer has been identified as a potentially significant water source for future development.

r. The CCT should proceed with the implementation of a pilot sea water desalination plant in order to learn lessons for the implementation of large-scale desalination. It is important to understand the pre and post-treatment processes, obtain a better understanding of the actual operating and capital costs associated with desalination, as well as any potential environmental impacts. The CCT should also monitor sea water quality along the Western Cape Coastline in order to develop a database of the varying sea water qualities.

s. The CCT and all other WSAs in the WCWSS should develop integrated effluent re-use policies for their areas of jurisdiction and also initiate feasibility studies to determine the full future

potential for effluent re-use in their respective areas. There should be close collaboration and integration between all the WSAs in this regard where appropriate. This would include the conceptual design of various effluent re-use interventions, and a comprehensive EIA.

t. The DWAF should initiate an integrated WCWSS effluent re-use study, which would include interventions such as the exchange of Berg River irrigation water.

u. The Strategy Steering Committee should monitor the progress of the CCT's TMG Aquifer Feasibility Study and Pilot Project and, after considering the outcomes, take a decision regarding further feasibility studies on the TMG Aquifer Scheme.

v. The capacity of the Voëlvlei bulk supply pipeline should urgently be assessed by the CCT, as the condition of this pipeline may impact on the viability of implementing either the Voëlvlei Phase 1 Scheme or the Michell's Pass Diversion Scheme. The cost implications on other supply-side interventions, utilising an additional pipeline from Voëlvlei to the CCT, should be assessed.

w. Owing to the potential impact of climate change on the reconciliation of supply and requirement, the DWAF should initiate an impact assessment study in this regard.

The Strategy was presented to the DWAF and to the City of Cape Town's Utility Services Portfolio Committee, where the recommendations contained in the report were adopted. The Reconciliation Strategy was subsequently approved by the CCT's Mayoral Committee and by Council (end May 2007). Any comments received from the public will be taken forward by the Strategy Steering Committee and will be taken into account in the further development and updating of the Strategy.

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